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CLINICAL PHYSIOLOGY OF THE CEREBELLUM.

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. . . and gives to airy nothing
A local habitation and a name.

In recent years considerable information regarding cerebellar function has become available, but as yet little attempt has been made to apply it clinically. At present the writer is engaged in a series of clinical and physiological studies of cerebellar function, in the Department of Surgery, University of Sydney, and at the Department of Neurosurgery in the Royal Prince Alfred Hospital, Sydney; and the present paper describes the clinico-physiological data with which these studies are being correlated. No extended description of the structure of the cerebellum or of its afferent and efferent connexions is included in this paper; these details may be found in any of the standard text-books of neurology. However, the key to the understanding of normal and abnormal cerebellar function depends upon a knowledge of its phylogenetic history, a brief review of which follows.

Phylogeny.

The vertebrate cerebellum, first evidenced in the primitive cyclostomes (for example, *Petromyzon*), is developed primarily as a central ganglionic mass related to the vestibular and lateral-line systems. Thus at its inception the cerebellar system is associated with proprioceptive functions, and the primate cerebellum subsequently developed consists of a series of functional and phylogenetic "levels" superordinated to this primitive vestibular foundation. In Ichthyopsida further elaboration occurs with the appearance of specialized proprioceptors related

to the anterior lateral-line system (seventh nerve), vestibular apparatus (eighth nerve) and posterior lateral-line system (tenth nerve). In Amphibia the separate cerebellar *Anlagen* developed from the cephalic end of the vestibular nuclei fuse across the mid-line. In salamanders two auricular lobes represent the vestibular components, while anteriorly there is a special component receiving trigeminal and spinal fibres. These are fused in the mid-line and form a true *corpus cerebelli* (Larsell, 1923).

With the advent of the terrestrial phase of existence the lateral-line system disappears forever, and the cerebellum remains primarily subordinated to vestibular impulses, contributions from other sources being added. The flocculus remains as the last vestige of that cerebellar tissue related to the lateral-line system, which became defunct when animal life took to the land, and therefore in higher primates its connexions are entirely vestibular.

The next step in development is the appearance of a further proprioceptive mechanism in the form of mesencephalo-cerebellar and spino-cerebellar systems, with which is correlated the antero-fixation of the cerebellum, a characteristic feature of the primate rhombencephalon (Kappers, 1936).

In the Reptilia the auricular lobes, developed in the salamanders, fuse, fore-shadowing the flocculo-nodular complex, while the final stage in the development of the chief cerebellar components is achieved with the appearance of the vermis, and with the demarcation of the flocculo-nodular lobe from the *corpus cerebelli* by the postero-lateral fissure of Larsell. At the same time the previously homogeneous *corpus cerebelli* becomes subdivided by the *fissura prima* of Elliot Smith.

In Aves nuclear centres are interposed between the cerebellar cortex and lower centres. The *nuclei fastigii* appear first and relay to medullary and mesencephalic centres, and then follow the more laterally situated *nucleus interpositus* (globose and emboliform) and *nucleus dentatus*, projecting to the mid-brain and diencephalon.

With the increasing dominance of the neopallium in the Mammalia, the primordial cerebellum becomes further elaborated; but the fundamental ground plan by now achieved remains. Under the influence of projection fibres from the *nuclei pontis* (coevolutionary structures of the neopallium), the cerebellar hemispheres are elaborated into the ansiform lobes, while at the same time the primitive olive is expanded into the neo-olive, projecting to the cerebellar hemispheres in a point-to-point fashion through the climbing fibres (Brodal, 1940), as seen in Figure I.

From this brief review of the phylogenetic history of the cerebellum it is apparent that three stages in development occur: (i) proliferation of vestibular nuclei into a vestibular cerebellum; (ii) addition of components related to impulses of spinal and mesencephalic origin (spino-mesencephalic cerebellum); (iii) elaboration of this unit, and expansion of the cerebellar hemispheres in response to neopallial development (cortico-ponto-olivary cerebellum).

These three stages are represented in the mature primate cerebellum by three components (see Figure II

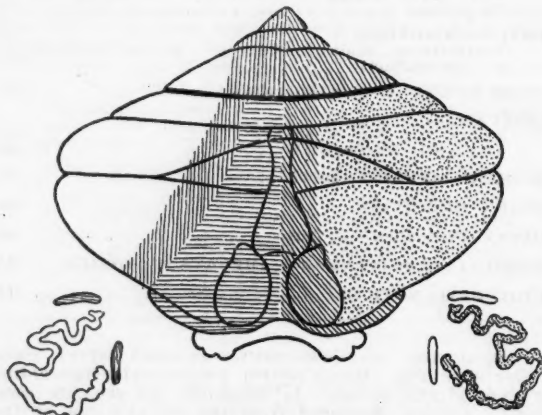


FIGURE I.

The projection of the palmo-olive (hatched area) and neo-olive (stippled area) upon the surface of the cerebellum. Although there is some degree of overlap, the former projects mainly to medial regions, while the latter sends fibres to the lateral part of the cerebellar hemispheres.

(a) distinguished by Ingvar (1918, 1923) as follows: (i) archicerebellum, a vestibular cerebellum, located in the flocculo-nodular lobule; (ii) palmo-cerebellum, a spino-bulbar cerebellum, comprising the anterior lobe and posterior vermis; (iii) neocerebellum, or ponto-olivary cerebellum, represented by the bulk of the cerebellar hemispheres (ansiform lobes) and the superior vermis.

More recently, Larsell (1937) and Dow (1942) have proposed a subdivision of the cerebellum based on the above facts, and on other morphological data, which has functional significance, and which can be correlated with Ingvar's phylogenetic classification. These authors divide the cerebellum into (i) the flocculo-nodular lobe and (ii) the *corpus cerebelli*.

The flocculo-nodular lobe is developed from the vestibular commissure and is a constant feature of all vertebrate cerebella. It is the only part of the cerebellum that sends and receives direct fibres from the vestibular nuclei, although a few fibres (see Figure II (b)) pass from these latter nuclei to the lingula and uvula as well (Ingvar, 1918). It is demarcated from the rest of the cerebellar mass by the postero-lateral fissure of Larsell, and projects directly to the vestibular nuclei of the same side (Dow, 1938, 1939).

The *corpus cerebelli* is the remainder of the cerebellar mass and is subdivided into two according to the plan of Bolk (1906), Riley (1929) and Abbie (1941), based on its afferent connexions. (i) The palmo-cerebellar division is

made up of the anterior lobe (lingula, *lobulus centralis* and culmen) and a median posterior part, composed of pyramid, uvula and paraflocculus (Larsell, 1937). The former region receives projections from the ventral spino-cerebellar tracts, while the latter receives the dorsal spino-cerebellar fibres, and those from the mesencephalon which relate cerebellar function to impulses derived from exteroceptive (especially visual and auditory) sources (Larsell, 1945). Its efferent fibres project upon the medial (globose and emboliform) cerebellar nuclei and to the *nuclei fastigii*. It receives both vestibular and spino-cerebellar fibres, and is concerned principally with postural reflexes (Gervase Connor, 1941). The projection of the accessory cuneate nucleus of Clarke and Monokow (Figure II (c)) is also upon the palmo-cerebellum (Ferraro and Barrera, 1935; Le Gros Clark, 1944). Lesions of this portion of the cerebellum alone, therefore, lead to disturbances chiefly restricted to the postural sphere. (ii) The neocerebellar division is made up of most of the cerebellar hemispheres (ansiform lobes especially) and the superior vermis. These structures appear coincidentally with the formation of the pyramidal tracts and *nuclei pontis*, and hence their afferent connexions (Figure II (d)) are mainly cortico-pontine, each half of the neocerebellum receiving fibres from the rostral portion of the contralateral *nuclei pontis* (Sunderland, 1940). This portion is concerned with the integration of volitional reactions, and lesions restricted to this division lead to disturbances of muscular coordination during volitional movement. The Purkinje cells of the neocerebellar cortex project to the posterior half of the dentate nucleus, to cells in the ventro-lateral part of its anterior half and to a few cells in the emboliform nucleus (Fulton, 1943).

On anatomical grounds such subdivision of the human cerebellum is not absolute; for example, the culmen (palmo-cerebellum) receives fibres from the pons which are probably of recent phylogenetic origin (Abbie, 1934; Dow, 1939; Sunderland, 1940), while the dorsal spino-cerebellar bundles project to both palmo-cerebellum and neocerebellum (*lobulus simplex*). Nevertheless, in spite of a certain degree of overlap (characteristic of all levels of the central nervous system) it can be stated that in the somatic sphere the cerebellum exhibits a more or less tripartite functional localization; that is, there are mechanisms for (i) equilibration (in the flocculo-nodular lobe), (ii) postural reflexes (in the palmo-cerebellar division of the *corpus cerebelli*), (iii) skilled movement (in the neocerebellar division of the *corpus cerebelli*). Moreover, such a functional classification is in accord with Ingvar's subdivision on a phylogenetic basis, also a tripartite classification.

This theory has recently received further confirmation from the work of Dow (1935, 1936, 1938, 1939, 1942), of Eccles (1929), of Liddell (1932), and of others. Dow (1939, 1942) has shown that stimulation of the eighth nerve produces action potentials restricted to the flocculo-nodular lobule. Stimulation of the anterior spinal nerve roots sets up action potentials localized in the anterior lobe (palmo-cerebellum), while stimulation of the precentral gyrus of the cerebral cortex causes similar reactions in the cerebellar hemispheres (neocerebellum). This work has now been elaborated by Adrian (1943), who has worked out more detailed maps of the cerebellum in lower animals; he has shown that different muscle groups and areas of the body are associated with specific areas which overlap to a certain extent, just as in the cerebral cortex (see Figure III).

Clinical Physiology.

Disturbances of cerebellar function that appear clinically may be related to the three spheres of cerebellar activity. While in few, if any, cases are lesions restricted pathologically to only one of these phylogenetic subdivisions, most of them may be analysed symptomatologically on this basis.

Therefore, the so-called "cerebellar signs" will be considered in terms of this tripartite subdivision, although it must be remembered that the usual clinical picture is a mixed one, the lesion spreading from one component

to involve the others, and often other cranial nerves and nuclei as well.

Detailed study of cerebellar function was initiated by the classic researches of Flourens (1824) and Luciani (1891, 1894) on the effects of cerebellar ablations, although the first experimental cerebellar ablation was performed in 1664 by Thomas Willis. Since the times of Flourens and Luciani the same methods have been utilized, together with detailed studies of "Nature's experiments" in the form of patients with cerebellar lesions verified at operation or post-mortem examination (Walshe, 1921, 1927; Cushing, 1930, 1931); while more recently oscillographic

tion in the reflexes or the appearance of tremor. That it is also related, in dogs and man, to the autonomic responses to motion and to the production of motion sickness, has recently been shown by Morton *et alii* (1947) and by Bard (unpublished). However, it plays no part in the primitive labyrinthine reflexes described in the decerebrate animal by Magnus and de Kleijn (McIntyre, 1941).

In monkeys, after flocculo-nodular ablation, oscillation of the head and neck occurs. If the lesion is made in the flocculo-nodular lobe towards one side of the mid-line, then rotation and tilting of the head and asymmetric posture of the head and neck result (Dow, 1938). This is a common

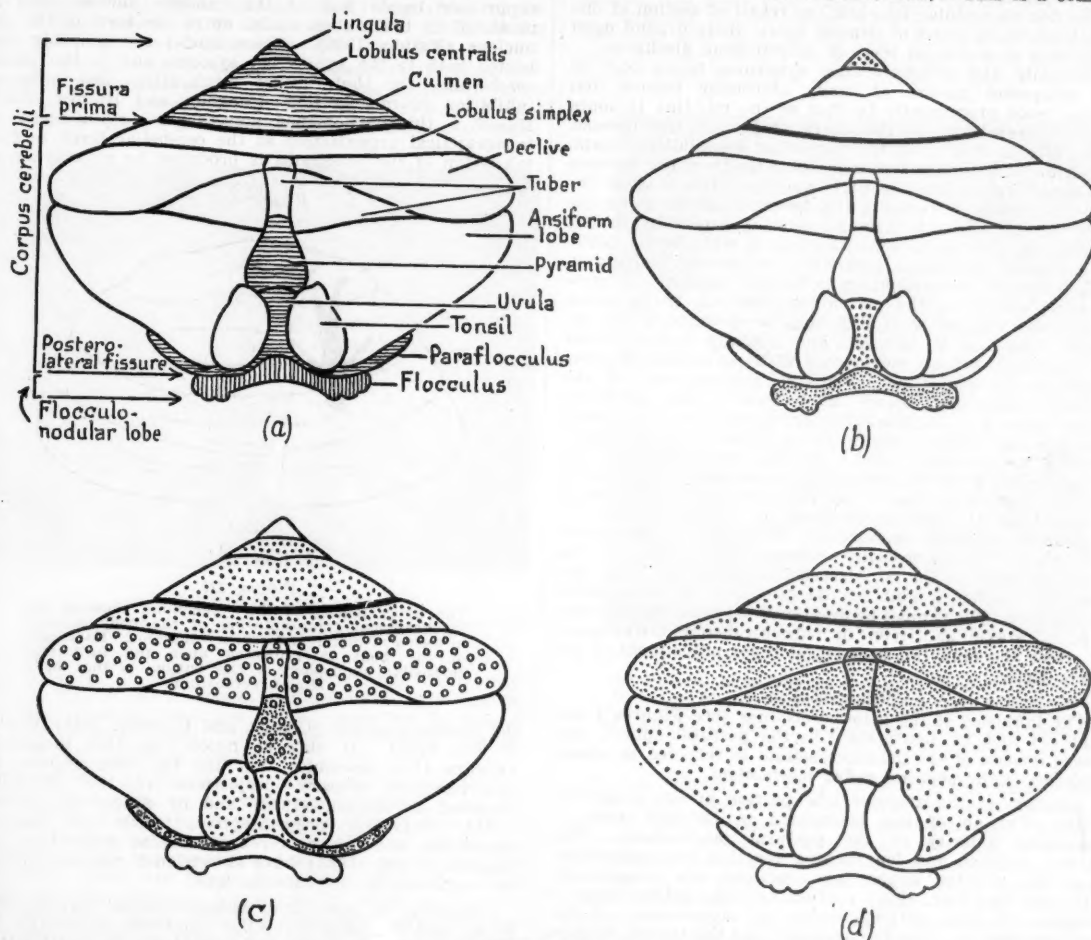


FIGURE II.

(a) The morphological subdivisions of the cerebellum into lobes and into archicerebellum (vertically hatched area), paleocerebellum (horizontally hatched area), and neocerebellum (unhatched area). (b) The projection of the vestibular system upon the cerebellar cortex. (c) The projection of the spinocerebellar system upon the cerebellar cortex. The projection from the dorsal and ventral spinocerebellar tracts is represented by stippling, while that from the dorsal funiculi via the arcuate system and the external cuneate nucleus is represented by circles. (d) The projection of the corticopontine system upon the cerebellar cortex. The density of the stippling represents the relative density of the projections.

methods have been employed to map out the cerebellar projection systems (Larsell, 1937; Dow, 1939, 1942; Adrian, 1943; Snider and Stowell, 1944). These investigations have provided further physiological evidence for consideration of a tripartite localization in the human cerebellum.

Regional Considerations.

Flocculo-nodular Lobes.

The flocculo-nodular lobe (see Figures II (a) and (b) and IV) functions chiefly in the equilibratory sphere, and its ablation leads to disturbed equilibration without altera-

sign in human patients with asymmetrically orientated cerebellar lesions. The head is usually rotated so that the chin points towards the affected side, and at the same time is tilted so that the vertex inclines away from the mid-line in the opposite direction (that is, away from the lesion). In all quadrupedal vertebrates with such lesions the head is always carried so that the ear on the affected side lies below that on the normal side. However, in man the opposite picture may obtain, according as the lesion is primarily destructive or irritative in its effects (Purves Stewart, 1945). In addition an unsteady abducted gait and the so-called "trunk ataxia" are present. This latter

feature is a misnomer, however, as the true fault lies in the ability to maintain balance, which is an expression of total muscular activity, not that of the trunk alone. Similar effects are seen in monkeys with lesions of the *nuclei fastigii* and fastigio-bulbar tracts (Farrero and Barrera, 1938), and in cats that have undergone unilateral eighth nerve section. This syndrome does not occur if removal of the flocculo-nodular lobule is preceded by bilateral labyrinthectomy (Dow, 1938), so it is probably a disorder primarily dependent upon vestibular imbalance. Moreover, experiments by the writer (Wyke, 1947) show that there is little difference between a unilateral lesion of the flocculo-nodular lobe and the result of section of one eighth nerve, in terms of clinical signs; these depend upon imbalance at a central level of labyrinthine discharge.

Clinically, the archicerebellar syndrome forms part of the composite picture of many cerebellar lesions, but figures most prominently in that of the mid-line tumours of the cerebellum in the early stages of the disease. Especially is this so in the cerebellar medulloblastomata, which have been shown to arise directly from the nodulus (Osterag, 1936). In the early stages of this disease the patient, usually a young child, becomes unsteady on his feet, readily loses his balance, tending especially to fall backwards, and walks unsteadily on a wide base. Little or no tremor is present, and when the patient is lying in bed, muscular incoordination is seldom apparent in arms or legs; but when the patient is standing, trunk movements are related with difficulty to movements of the limbs. The head is unsteady, and difficulty is experienced in coordinating head movements with movement of other parts of the body. Nystagmus is seldom seen, as the patient usually dies before involvement of the vestibular nuclei occurs. As the tumour spreads it eventually destroys the nodule, the uvula and the mid-line nuclei (Bailey and Cushing, 1925), so that other features are added to the pure archicerebellar syndrome. The clinical picture is further clouded by the results of rising intracranial pressure and development of hydrocephalus.

In brief, however, impairment of balance is the invariable sign of archicerebellar disease, and constitutes the *sine qua non* of the archicerebellar syndrome. An unsteady, wide-based gait is diagnostic of archicerebellar dysfunction; but it must be differentiated from the different type of ataxic gait seen in palaeocerebellar disturbance, in which the fault lies in postural reflex adjustment of the lower limbs.

Palaeocerebellum.

The influence of the palaeocerebellum (see Figures I (a) and (c) and V) lies mainly in the postural sphere, and hence disease of the palaeocerebellum is reflected in abnormalities of the postural reflex mechanism.

Ablation of the anterior lobe portion of the palaeocerebellar division of the cerebellum in animals leads to increased activity of the postural mechanisms. The stretch reflexes and lengthening reaction are augmented, and the positive supporting reactions are exaggerated (Bremer and Ley, 1927). Often extreme opisthotonus is present (a sign pathognomonic of involvement of the anterior lobe in cerebellar lesions), and the tendon reflexes are hyperactive. The vasomotor mechanisms are abnormally labile, in response to changes in environmental temperature, producing the so-called "vasomotor ataxia" (Connor, 1941), which is further evidence in favour of the claim by Zimkina and Veronine (1935) and by Moruzzi (1940) for autonomic representation in the cerebellum. In some cases gastric hemorrhages (gastrostaxis or ulceration) follow interference with the anterior lobe of the cerebellum (Cushing, 1932). Pronounced extensor dominance is present, especially in the early stages, and the postural reflexes are abnormally responsive to labyrinthine and tonic neck reflexes. In many cases the picture closely resembles that described by Magnus and de Kleijn (1912, 1924) as characteristic of decerebration.

In brief, destruction of the palaeocerebellum produces varied effects, but all have two features in common: (1) "release" of the local extensor proprioceptive mechanisms of the neck and extremities, resulting in an abnormal response in the anti-gravity muscles to postural reflex

stimulation; (2) a similar "release" of the labyrinthine tonic influences, which appear to be inhibited to some extent by palaeocerebellar activity (Moruzzi, 1936). These are the essential components of what might be distinguished as the "palaeocerebellar syndrome", various elements of which appear in lesions of this portion of the cerebellum in man.

On the other hand, stimulation of the anterior lobe inhibits homolateral extensor tone and abolishes the rigidity in decerebrate preparations (Bremer, 1922, 1924; Miller and Banting, 1922; Moruzzi, 1936). This inhibition resembles that produced by stimulation of the cortical suppressor bands and of the caudate nucleus, and is mediated by brain stem nuclei up to the level of the red nucleus (Fulton, 1946). These nuclei are probably connected both to the suppressor systems and to the palaeocerebellum, for their direct stimulation also produces inhibition of muscle tone (Magoun and Rhines, 1946). Moreover, this phenomenon possesses a certain degree of topographical organization at the cerebellar level, in that inhibition of the hindlimbs is produced by stimulation of

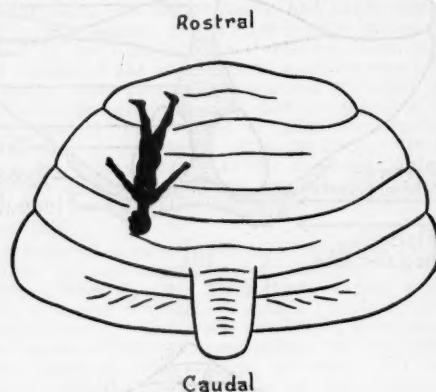


FIGURE III.

The upper aspect of the cerebellum, showing the topographical representation of the body surface in terms of motor and sensory function. Each half of the body is projected upon the ipsilateral cerebellar hemisphere. The outline is that of a simian cerebellum.

the *lobulus simplex* (Connor and German, 1941; Woolsey *et alii*, 1945). It may be noted that this localization (Figure III) resembles that for the exteroceptive and proprioceptive sensory projections to the cerebellum proposed by Adrian (1943) and by Snider and Stowell (1942, 1944) for proprioceptive, tactile and auditory modalities, and for the cerebrocerebellar projections; and Magoun *et alii* (1935) have shown such representation to be ipsilateral in the anterior lobe.

Clinically, in man, pure palaeocerebellar lesions rarely occur, and the palaeocerebellar syndrome is usually seen only in incomplete forms and combined with manifestations of lesions in other spheres. It is most marked when the anterior lobe of the cerebellum (Figure V) is compressed or invaded by supratentorial tumours (for example, pineal lesions). However, the appearance of the positive supporting reaction in a case of cerebellar disease should lead to suspicion of palaeocerebellar involvement, especially in the anterior lobe (Schwab, 1927). On the other hand, in sub-human primates and in lower vertebrates, the palaeocerebellar symptoms are more evident, as the neocerebellum has not yet attained the overwhelming dominance which it enjoys in *Homo sapiens*.

Neocerebellum.

The neocerebellum (see Figures II (a) and (d)) and the precentral cerebral cortex are intimately related through the *nuclei pontis*, and their interplay profoundly affects the picture of neocerebellar disease (Fulton, 1936). Moreover, lesions of one frontal lobe (neopallium) may

produce a clinical picture difficult to distinguish from that of a lesion in the opposite cerebellar hemisphere (neocerebellum). Additional afferents (Figure 1) are derived from the neo-olive (Dow, 1939; Brodal, 1940). Neocerebellar stimulation enhances the electrical excitability of the sensori-motor area of the cerebral cortex (Rossi, 1925) and also its spontaneous electrical rhythmic activity (Dusser de Barenne, 1936; Walker, 1938). The cortico-ponto-cerebellar system is an important component of the extrapyramidal motor system, its principal concern being with the fine integration of delicate volitional movements, especially those of the prehensile upper extremities. Because of the primate dominance of this division of the cerebellum, neocerebellar symptoms tend to dominate the clinical picture of human cerebellar pathology.

The neocerebellar syndrome is protean in its manifestations, which, however, lie mainly in the sphere of voluntary muscular activity. The principal disturbance is that of incoordination (or asynergia) during movement, mani-

of many cerebellar disorders. Volitional acts lose their normal smoothness and fluidity, being broken up into a series of small, individual acts, exhibited in the jerky performance of the finger-nose tests and the fractionation of turning movements of the body. The decomposition and dysmetria are often well evidenced in the patient's writing, which is scrawling, with letters of uneven size and outline, the whole tending to be larger than normal (cerebellar macrographia).

Disturbances of Rate.—Movements of limbs on the side of the lesion tend to be slower in performance, as well as uneven, and there is a longer latent period than normal in initiating the movement. This is especially evident in rhythmic acts such as walking; in isolated movements some may be slower than normal, while others are carried out precipitately, and at an abnormal velocity.

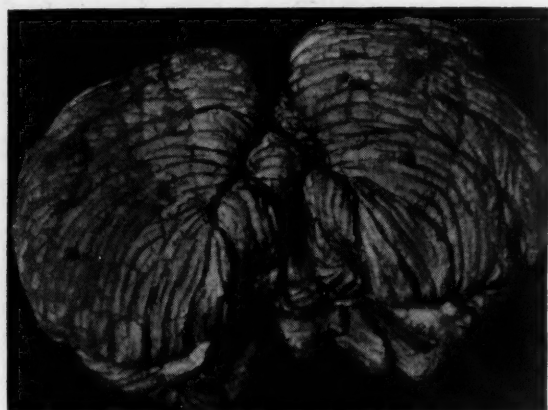


FIGURE IV.

The inferior aspect of the human cerebellum, showing the inferior vermis and the flocculo-nodular region.



FIGURE V.

The superior aspect of the human cerebellum, showing the region of the anterior lobe (paleocerebellum). It is by pressure upon or invasion into this surface that supratentorial tumours (for example, pineal neoplasms) may produce cerebellar symptoms.

festated chiefly in the extremities, which are ipsilaterally represented in the cerebellar hemispheres. The elements of this syndrome were first clearly described in man by Gordon Holmes (1922), and consist of varying combinations of the following components.

Hypotonia.—Hypotonia is more marked in man than in lower primates, and its intensity may be related to the size of the cortical lesion in the cerebellum. Involvement of the dentate nuclei perhaps augments it (Fulton, 1943); and in sub-primate vertebrates it does not occur unless the cerebellar nuclei are involved (de Barenne, 1936). It is especially prominent in the arms, the limb on the side of the lesion falling away if both arms are held outstretched while the eyes are closed. There is decreased resistance to passive movement, and a "flail limb" may be demonstrable. The hypotonus is manifest not only in the extensors but also in the abductors of the limbs, and an abduction reaction may be seen in the homolateral outstretched arm (Splegal and Sommer, 1944). The altered muscle tone also plays a part in the production of the "pendulum" knee jerk described by Holmes. These effects are all homolateral.

Dysmetria.—Dysmetria is the result of impaired control of muscular contraction. Any volitional movement tends to be overdone, the patient overshooting the mark, as in the finger-nose and the finger-nose-finger tests. Coordinated control of agonists and antagonists is also faulty, and the "rebound phenomenon" and dysidiadokokinesia may be demonstrable as a result.

Decomposition of Movement.—Movements in general tend to be "disorderly, dysmetric and discontinuous", resulting in the generalized ataxia which is so prominent a feature

Tremor.—Tremor is an expression of the discontinuity of volitional movement. Its presence does not depend entirely upon involvement of the cerebellar cortex alone, as it occurs transiently with lesions of the dentate nucleus, and becomes permanent if the *nucleus interpositus* is also involved in the lesion (Fulton, 1943). It is unaffected by closing the eyes. There are many different types of tremor, but that associated with cerebellar lesions is essentially a terminal tremor, becoming more marked, with increase in rate and amplitude as the movement approaches its climax. When the limb is at rest no tremor is present. It is sometimes referred to as "intention tremor", but differs from the intention tremor of disseminated sclerosis in that the oscillations are coarser and less decisive. The intensity of the tremor is proportional to the intensity of the volitional movement, and indeed, the tremor is not the result of the cerebellar lesion *per se*, but represents imperfect cerebral cortical compensation (Fulton, 1936), for the frontal cortex can compensate in large measure for a cerebellar defect, particularly if this is in the neocerebellar sphere. When area 6 on each side is removed from an animal with a unilateral neocerebellar lesion, the tremor is augmented (Aring and Fulton, 1936). If area 4 on one side is then destroyed, the tremor diminishes on the opposite side; if area 4 is bilaterally ablated, the tremor vanishes entirely. It thus appears that the *corpus cerebelli* is responsible for providing a background of postural

reactions against which phasic contractions emanating from the pyramidal system appear at the local spinal level as coordinated voluntary movements. If the *corpus cerebelli* is injured, the postural background is lost; removal of the premotor area, with resultant destruction of the extrapyramidal cortical projections, particularly those from area 4, still further impairs control of the postural sphere, with consequent increase in difficulty in executing volitional acts. The disappearance of cerebellar symptoms after removal of area 4 is probably a consequence of the withdrawal of voluntary innervation.

Speech Disturbances.—Speech disturbances occur as the result of asynergia of the muscles of phonation. The speech becomes slow and hesitant, and the breath intervals are irregularly spaced. Pronunciation is faulty, the general effect being a slurred type of speech. The voice tends to fall off towards the end of phrases, and the last few words may be a meaningless mumble.

In brief, the neocerebellar syndrome consists of muscular asthenia, atonia and ataxia (Luciani triad), which may be manifested in some or all of the muscles of the limbs, trunk, larynx and eye. However, the appearance of this symptomatology is not related to lesions restricted to the neocerebellar cortex, as is shown by the work of Keller, Roy and Chase (1937), who removed the entire neocerebellum and the lateral cerebellar nuclei from monkeys and dogs without the production of cerebellar signs. This may be due to "cortical compensation", to the fact that some other mechanism has to be involved in the lesion, or to the relative unimportance of the neocerebellum in these animals. The efficiency with which this compensatory mechanism functions at the primate level is indicated by the fact that, after removal of half the human cerebellum, it may be impossible, after some months, to demonstrate any impairment of neurological function. The writer has examined three patients who had undergone hemispherectomy at the hands of Dr. Gilbert Phillips, and in each instance it was impossible to determine clinically which was the side of operation, or to detect any signs of residual cerebellar deficit.

Nystagmus.

The mechanism underlying nystagmus is complex, and will be discussed in detail in another communication. It is more marked in human patients than in animals with cerebellar lesions. Nystagmus occurs physiologically in persons watching rapidly passing objects or as the result of fatigue, and pathologically in many diseases affecting the cerebello-vestibular unit. It results from an imbalance in the impulses bombarding the ocular nuclei, so that their normal steady tonic discharge into the ocular muscles becomes incoordinate, and this is manifest as a series of jerking movements of the eyeball. Clinically, nystagmus may be horizontal, vertical, rotatory or compound (any combination of the preceding three types); but its appearance on lateral deviation of the eye depends upon disorganization of the vestibular nuclei (Fulton, 1943).

The movements consist of two rhythmic phases, a slow component, represented by a gradual oscillation of the eyeball about the resting position, followed by a quick jerk in the opposite direction. Both these effects are central in origin, and are unrelated to the activity of the ocular muscles themselves (McIntyre, 1939). The slow component depends upon impulses arriving from the vestibular nuclei, principally by way of the medial longitudinal bundle and vestibulo-mesencephalic tract, at the ocular nuclei. The quick component, previously thought to be cortical in origin, has been shown to occur in the decorticated animal, and probably is the result of phasic stimulation of high-threshold neurones in the *substantia reticularis* of the brain stem (Lorente de No, 1933; McIntyre, 1939). The simultaneous production of the corresponding phases in the two eyes is the result of their reciprocal innervation at the mesencephalic level, mediated principally by the medial longitudinal bundle.

The movements are greatly influenced by the direction of the patient's gaze. If nystagmus is evident only on the patient's looking in the direction of the quick component, it is called first degree nystagmus. Second degree nystagmus is present when the movements occur not only

on the patient's looking as above, but also on his looking ahead (spontaneous nystagmus). Third degree nystagmus occurs when the nystagmoid oscillations are present on the patient's looking in the direction of the slow component, as well as in the other two directions (Spiegel and Sommer, 1944).

Nystagmus may occur in the blind (ocular nystagmus), the eye movements being irregular and wandering, and it is sometimes seen in those long accustomed to work under conditions of poor illumination (for example, miner's nystagmus). It may also occur in association with paresis of the extrinsic ocular muscles (oculo-paretic nystagmus).

Cerebellar nystagmus is never vertical (vertical nystagmus, if present, indicates involvement of the vestibular nuclei), and consists of a slow deviation back to the resting position if the eyes follow a laterally moving object, followed by a quick return to the visualized object in the lateral field.

Vestibular nystagmus may be in any plane (usually horizontal) and is the result of imbalance of stimuli arising in the semicircular canals. There is a slow deviation from the resting position, followed by a rapid flick back to the fixation point. Vestibular nystagmus is often accompanied by nausea, vertigo and past pointing, and may be elicited clinically, to test the integrity of the labyrinth and vestibular portion of the eighth nerve, by rotating the patient in a Bárány chair, or by the warm and cold caloric tests. If warm water is used, the slow component is directed away from the tested side, and the opposite occurs when cold water is used. These features result, in the case of caloric tests, from stimulation of the ampullary cristae by convection currents set up in the endolymph of the lateral semicircular canal; the other canals are hardly affected by the stimulus (Fitzgerald and Hallpike, 1942; Cawthorne *et alii*, 1942).

Caloric Tests.

If the caloric tests are carried out by the method of Fitzgerald and Hallpike (1942), the duration of the cold reaction usually exceeds that of the warm reaction by about ten seconds, although the reverse is the case in about 10% of normal subjects. Abnormal reactions are of three types—directional preponderance, canal paresis and combined responses. Directional preponderance occurs when the direction of nystagmus is predominantly towards one side, no matter which labyrinth is subjected to warm stimulation. The duration of nystagmus is also increased towards the dominant side. This response is due to interference with impulses coming from the utricle on the side opposite to that towards which the nystagmus is directed, in the presence of normally functioning canals. Canal paresis occurs when the response of one ear to both warm and cold stimulation is diminished, in comparison with that of the opposite ear. It results from interference with the function of the external canal on the affected side. Combined forms of response are seen in cases in which both utricular and labyrinthine lesions are present.

Conclusions.

From the foregoing discussion, it is apparent that the symptoms and signs of cerebellar dysfunction may be resolved into three complexes—the archicerebellar syndrome, the palaeocerebellar syndrome and the neocerebellar syndrome—each of which is determined by the phylogenetic history and connexions of the region of cerebellum affected. Clinical analysis of cases on this basis provides accurate localization of lesions in the posterior cranial fossa, which may be confirmed by study of the disturbances of function of related extracerebellar tracts and cranial nerves.

Summary.

1. The phylogenetic history of the vertebrate cerebellum is reviewed and shown to consist of three principal steps.
2. Three subdivisions of the cerebellum (archicerebellum, palaeocerebellum and neocerebellum) are described briefly in terms of phylogeny, morphology and their connexions.
3. The functions of these three subdivisions are described in terms of their application to clinical diagnosis

of lesions of the cerebellar apparatus. Three related clinical syndromes are described, recognition of which facilitates diagnosis of lesions in the posterior cranial fossa.

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FANNING ISLAND (CENTRAL PACIFIC): ITS PAST AND PRESENT.

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FANNING ISLAND, called by the natives of Manihiki "Tapuacangi", which means "heavenly footprint" (owing to the configuration of the island), lies 228 nautical miles north of the equator. Its geographical position, as determined by Dr. Otto Klotz and F. W. O. Werry, is $3^{\circ} 54' 38''$ north latitude and $159^{\circ} 23' 27''$ west longitude. The position of English Harbour, the entrance to the lagoon, is $3^{\circ} 51' 23''$ north latitude and $159^{\circ} 21' 50''$ west longitude, as surveyed by Her Majesty's Ship *Penguin* in 1897 (Captain A. Mostyn Field, R.N.).

Though the remote history of Fanning Island is still rather obscure, yet it can be shown almost with certainty that the island was occupied in the sixteenth century by people of Polynesian origin, most probably from Tonga. The work done by Kenneth P. Emory, of the B. P. Bishop Museum, Honolulu, is of particular value, because it throws light on the past of the island.⁽¹⁾ A few minutes' walk southward from the lagoon jetty of the cable station will bring us to the dressed-stone enclosure, where the south-east and south-west corner stones are of particular interest. They are L-shaped, a form described only in Tonga and used as corner stones in temples of the sixteenth century. There are other things which support the theory that Fanning Island was occupied by Polynesians from Tonga. They are Polynesian fishing hooks of the Tongan type, and basalt adzes, shaped like those of Tonga. These were found in an old grave at Fanning Island.

Polynesians, those "Vikings of the Sunrise", as they are called by Peter H. Buck, a noted ethnologist of the Pacific,⁽²⁾ came to the Pacific from the Malay Archipelago between the fourth and fifth centuries A.D. They settled down in the Society Islands group and made the island of Hawaii or Hawaiki, later named Raiatea, their cultural centre.⁽³⁾ From Hawaiki and later from Tahiti, Polynesians reached Hawaii in the north, New Zealand in the south,

and Easter Island in the east. On the way to the north they had to pass Fanning Island, as this course ensured more favourable winds than by way of the Tuamotus and Marquesas Islands; this way was known to the Polynesians, and they probably preferred it in sailing from Hawaii back to Tahiti.

Whenever Polynesians used to go on their large voyaging canoes, they used to carry with them their animals (pigs, dogs and fowls) and their plants (coconuts, banana, breadfruit, taro and yam—products which their ancestors brought from the Malay Archipelago down to the Pacific).⁽⁴⁾ It is interesting to note that in the few tombs which were opened at Fanning Island, the bones of fowls and apparently of dogs were found together with ashes and fragments of human bones.

Fanning Island was discovered on June 11, 1798, by Captain Edmund Fanning, of the American whaling schooner *Betsy*. He landed on the southern shore of the island in the vicinity of what is now known as English Harbour, but found no evidence of human occupation. In his memoirs, called "Voyages and Discoveries in the South Seas", he states that soon after landing he "took a stroll into the interior for a few minutes, among the upland grasses and various kinds of trees. . . . At the barren spots, the birds, boobies, knoddies, and the like,

were quietly sitting on their nests, so fearless and gentle as to be easily taken by hand".⁽⁵⁾ Captain Fanning also noted the presence of coconut trees, "whose fruit then lay strewn around, covering the ground from one to three feet deep, and seemed to have ripened and thus to have fallen for many years past".⁽⁶⁾

Captain Donald MacKay, a few years later, was the first to find some heaps of stones, which "to all appearance, from their order and regularity, were thus placed by the hands of men . . .". He caused one of these piles to be removed and found it to contain "a stone case filled with ashes, fragments of human bones, stone,

shell and bone tools, various ornaments, spear and arrow heads of bone and stone".⁽⁷⁾

J. Oliver, who visited Fanning Island in 1832, discovered a small group of Hawaiians "who had come in some vessel, and had built three or four huts near the beach".⁽⁸⁾

E. Lucett, in 1848, met at Fanning Island "a man of Crusoe habits . . . [who] had devoted himself to the rearing of pigs".⁽⁹⁾

John English took possession of Fanning Island probably in the early fifties, and about 1857 William Greig and Bicknell arrived at Fanning Island and joined English in his enterprise to work a coconut oil manufactory. They engaged some natives from Manihiki as labourers and considerably increased the area under coconut palms, so that by 1862 the export of coconut oil to Honolulu had already reached 44,000 gallons yearly.⁽¹⁰⁾

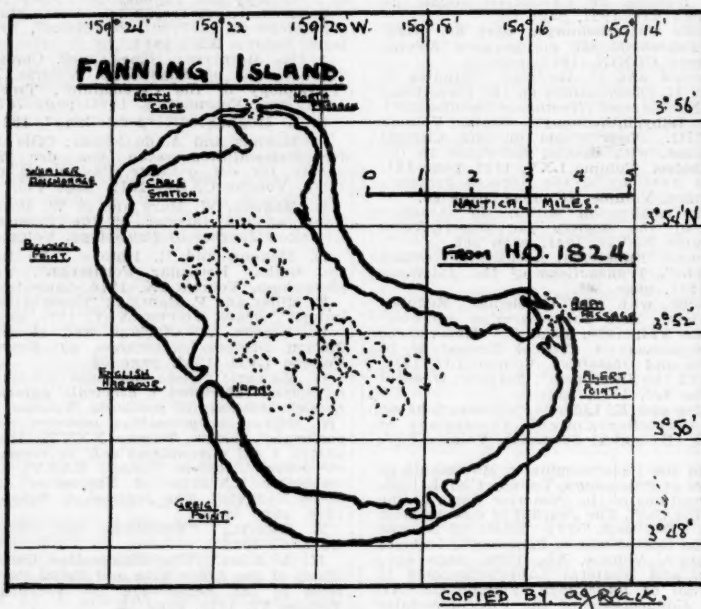


FIGURE I.
Map of Fanning Island. (From H.O. 1824, copied by A. J. Black.)

At Fanning Island there is a cable relay station which breaks the stretch between Bamfield (Canada) and Suva (Fiji). The cable between Bamfield and Fanning Island is the longest in the world; it covers a distance of 3450 nautical miles, reaching a maximum depth of 3400 fathoms.

Fanning Island was formally annexed to Great Britain in 1888 by Captain William Wiseman, of Her Majesty's Ship *Caroline*⁽⁷⁾ and is now a part of the Gilbert and Ellice Islands colony.

Fanning Island's Formation.

Fanning Island is a genuine atoll, a narrow land area enclosing a lagoon with an area of approximately 40 to 45 square miles. The extreme measurements of the island are as follows: length 10.5 miles, width 5.5 miles, with a coastline of approximately 31.5 miles. The total area of the island is approximately 8500 acres, of which about 3122 acres are planted with coconut. In 1937 there were approximately 140,000 mature palms of use at Fanning Island.⁽⁸⁾

The maximum elevation of the island is about ten feet above mean tide. Where phosphate rock deposits occur,



FIGURE II.

Entrance to the lagoon (view from north-west).

the elevation of the land is mostly between six and eight feet. The lowland, which in many places is occupied by coconut plantations, is only two to three feet above sea level.

A rocky barrier, formed of large coral slabs, encircles the island, from 200 to 300 feet inland from the outside fringe. The rocks are especially prominent on the eastern side of the island, being well visible for some distance from the shore at low tide.

The land area is divided into three distinct islands by the following passages: (i) English Harbour passage on the western side of the island; it is about 850 feet wide, but only about 200 feet are navigable; there is a current of five knots through the passage at ebb and flow; (ii) Rapa or shark passage on the eastern side of the island, about 525 feet wide, but not navigable; and (iii) North passage, about 2000 feet wide and also not navigable. Both Rapa and North passages can be easily crossed on foot during low tide. Each part of the island is also broken in many places by tidal and semi-tidal flats and lakes.

The formation of the soil throughout the island is more or less uniform, but in the north-western corner of the island it is distinctly different.

The following analysis of the soil common on the island is of interest:⁽⁹⁾

Fine Earth.	
Nitrogen	0.57%
Lime	47.22%
Potash	0.07%
Phosphoric acid	10.08%
Coarse Earth.	
Coral fragments	42.06%

In the north-western corner of the island, which is higher than other parts, pisonia trees grow readily, together with numerous "umbrella" trees and native shrubs with bunchgrass between. Ferns are also numerous there. In general the vegetation in this part springs up rapidly, but coconut palms are almost absent, being entirely confined to the shores of a few lakes. This is probably due to the high elevation of the coral flats and to the accumulation of guano.

The surface soil here is composed of decayed vegetable matter, accumulated through generations of fallen trees and leaves. It is poor in chlorides, but rich in total soluble matter and in total nitrogen and phosphorus.

The guano deposits at Fanning Island were worked in the seventies and eighties of last century, but copra soon became the chief industry, because the deposits of guano were found to be of a low grade.

The outer or ocean sides of the island are amongst the highest places in the atoll. Their shelves are composed of shingle-like stones, once living coral heads, covered in places by a layer of coral sand.

The massive corals, such as *Porites* and *Pavonia*, are numerous on the surf-beaten shores, together with some



FIGURE III.

Along the lagoon beach.

Montipora, *Pocillopora* and *Millepora*. In the channel of English Harbour and in the centre of the lagoon, branching and laminated forms, such as *Seriatopora*, *Madrepora* and *Stylopora*, can be found, together with massive corals. The deepest water in the lagoon is between 30 and 50 feet deep.

The lagoon beaches are composed of sand which is a mixture of fine particles of coral and fragments of broken shells. In a few places, especially round North and Rapa passages, where limestone rocks are six to eight feet over mean tide level, some colonies of branching living corals can be seen. They are usually found on the bottom of a few natural ponds, four to five feet deep. Otherwise the lagoon shores are very shallow; there are no living corals, and they are filled up with greyish-white fine oozy mud, the final stage of coral degradation.

It is evident that these parts of the lagoon are growing more and more shallow, as every wave which breaks through the passages washes in fragments of coral and fine sand. But the process of filling the lagoon with dead coral and sand is surprisingly slow, judging by the few available landmarks.

The area of dressed-stone enclosure (sixteenth century ruins) is only between two and a half and three feet above mean tide in the lagoon. This enclosure is at least 400 years old. Yet another landmark—an ancient tomb, situated to the north-east of the enclosure, and standing on a square earth platform—is only three feet above mean tide. This tomb is just sixty feet off the lagoon shore.

There is another interesting landmark about half a mile to the north of the lagoon jetty. It is a solid limestone

rock, resting on the breccia platform and covered with solid guano deposits reaching in places a thickness of three feet. The breccia platform is now two feet above high tide level, and the rock, which is almost two feet thick, has numerous strata made by the waves in the days when only a few rocks appeared above sea level on the site of the present island.

Crustacea, Fish, Birds and Animals.

The crustacean fauna, as well as the echinoderm and molluscan, is well represented at Fanning Island, both on the outer shores and in the lagoon, as well as on the land.

C. H. Edmondson, in his report on "Crustacea from Palmyra and Fanning Islands",⁽⁹⁾ describes 54 different crustaceans collected at Fanning Island. Amongst them the following are common and abundant: (i) *Uca annulipes* (Milne Edwards) or "fiddler crab", burrowing in the mud flats; this crab undoubtedly plays an important role in the degradation of the coral sand in the lagoonlets, where it is abundant; (ii) *Cardisoma carnifex* (Herbst), another burrowing land crab; it is abundant and obnoxious owing to its prevalence and habits, but is a welcome



FIGURE IV.

Cable and Wireless, Limited, office building.

addition to the coconut plantation area; owing to the numerous holes it burrows, the oxidation of the soil is more complete with this crab's help; (iii) *Canobita rugosa* (Milne Edwards), the most common of all hermit crabs on the island; it is widely used by fishermen for baiting hooks; (iv) *Birgus latro* (Leach), or "coconut crab", now almost exterminated at Fanning Island; this gigantic crab has quite incredible strength; with its great pincers it can break bottles, tear up tins and cut wire netting easily. Dr. F. Wood Jones, in his book "Coral and Atolls",⁽¹⁰⁾ describes the *Birgus* also as "one of the cleverest animals living". This crab is highly prized both by natives and by Chinese as an article of food.

Fish are abundant at Fanning Island, both in the ocean and in the lagoon; fish live in thousands along the barrier and rocky shores.

Amongst the best edible fishes at Fanning Island, the following may be mentioned:¹

1. Jack (E), *paihere* (M), *ulua* (H), white, black and striped. White *paihere* is probably the most delicious, especially if the fish is not over six to eight pounds in size. The record weights for *paihere* caught at Fanning Island are: white *paihere*, 93 pounds (J. Lorking, 1928); black *paihere*, 69 pounds (H. Christian, 1918). The first was caught in the channel of English Harbour, the second from the front wharf. White *paihere* inhabits mostly sandy beaches and is common in the lagoon. Black *paihere* is usually caught in the ocean and along reefs.

¹ (E), English name; (M), Manihikian name; (G), Gilbertese name; (H), Hawaiian name.

2. Leatherback (E), *lai* (M and H), *te nari* (G); possibly *Scomberoides* species. It has a white flaky flesh, but is very tasty when fried. Its average weight is about one and a half to two pounds, though a five and a half pound specimen was caught by E. L. Waldon in 1931 from the front wharf. *Lai* can be caught both in the ocean and in the lagoon.

3. Mullet (E), *karehi* (M), *te aua* (G), *amaama* (H); *Mugil* species. This is an excellent food fish. It is common in the lagoon and caught also in the ocean. The average weight at Fanning Island is about ten to twelve ounces.

4. Barracuda (E), *ono* and *kaku* (M), *te ikabaua* (G), *kaku* (H); *Sphyræna barracuda*. This is delicious when fried. It is a comparatively rare fish at Fanning Island. It is present both in the ocean and in the lagoon. The record specimen at Fanning Island was caught in the ocean, close to the front wharf, by J. M. Croger in 1935, its weight being 68 pounds.

5. Greenfish (E), *maratea* (M), *te karun* (G); *Pseudoscærus* species. This is caught mostly in the ocean or along reefs, but occasionally also in the lagoon. It is an excellent food fish. The record fish, weighing 78 pounds,



FIGURE V.

The road to the lagoon.

was caught by C. W. Brent in 1945 in the channel of English Harbour.

Since February, 1946, numerous cases of fish poisoning have been recorded, and very few people now dare to eat fish, especially if it has been caught in the ocean or in the channel of English Harbour. The problem of fish poisoning at Fanning Island will be discussed at length in a second article.

Amongst the very numerous species of fish at Fanning Island, two are of particular interest. These are: (i) parrotfish or kakatua (E), *takerepoti* (M), *te inai* or *te noku-noku* (G), *uhu* (H) (*Scarus* species), and (ii) balloonfish (E), *hui* (M), *te buni* (G), "*O*" *opuhue* (H) (*Tetrodon* species). These both quite possibly play some part in the making of sand from the coral rocks of the barrier (kakatua) and from crabs and shellfish (tetrodon).

Dr. F. Wood Jones^(10a) pays special attention to the role of kakatua. He makes the following statement:

The part played by these fish in the making of sand must be considerable, for every rock of the barrier (at Keeling-Cocos Islands) is scored by their hard beaks. . . . As the average weight of dry sand in an individual's intestinal canal is nearly two ounces, the bulk of coral rock converted into sand by these creatures must be very great indeed.

The bright green kakatua is a common fish amongst the rocks and coral slabs of the ocean beaches at Fanning Island; but whether its role in the making of sand at Fanning Island is as important as Wood Jones thinks, is hard to say. It is true that the amount of sand in the intestinal canal is really amazing. This applies

equally to tetrodon, a common fish along the lagoon beaches and rocks. Both kakatua and tetrodon have hard beaks, with which they can bite rock in search of food. With its sharp teeth tetrodon can easily crush crabs and shellfish and inflict a deep wound on legs (toes) and hands (fingers) of careless fishermen standing in the water, for I have seen a few cases of tetrodon's bite at Fanning Island. E. Y. Hosaka, in his interesting book "Sporting Fishing in Hawaii",⁽¹⁾ gives this warning: "Never put your finger in or near its mouth, for many people have lost part of a finger by such carelessness."

Sharks are common in the lagoon and along the barrier, but no instance of their attacking a man has yet been recorded. The record specimen of shark at Fanning Island was caught from the front wharf by L. Davidson in 1931, its length being eight feet six inches.



FIGURE VI.

In the bush. One of the tallest palms on the island.

Among other creatures eels are numerous along rocky shores. The commonest is a grey eel, and its bite is deep and painful. A few months before I arrived at Fanning Island a native was bitten by an eel while standing and fishing in the lagoon. He had the gastrocnemius muscles of a leg almost torn away.

Birds are also numerous at Fanning Island, though they are not equally distributed in all parts of the island, and are confined only to a few species. Frigate ("man-o-war") birds, gannets ("booby birds"), terns (three types; the white tern is the prettiest), a highly coloured parakeet,

two types of snipe and a curlew are the only birds I have seen at Fanning Island, besides a few migratory birds.

The only animals on the island are numerous dogs, kept by Gilbertese labourers as pets, cats and some pigs. Rats and mice are numerous. The rats are firmly established, and they are in the habit of climbing the coconut palms. In fact, some of them are reared in the crowns of the palm trees.

There are no land snakes at Fanning Island.

Mosquitoes and Poisonous Arthropods.

Mosquitoes are numerous, and though Anophelini are absent and malaria is unknown at Fanning Island, Culicini are well represented, and amongst them *Aedes scutellaris* is present and has been identified by the School of Public Health and Tropical Medicine, University of Sydney.

Sporadic cases of dengue fever have been recorded by me at Fanning Island and proved experimentally. They will be described in another paper, along with other medical problems.

Scorpions are comparatively rare and of small size. I have seen only a few cases of scorpion bite, and all of them were mild.

Poisonous centipedes are numerous, some of them reaching seven inches in length. Their bites, though not fatal, are very painful, and are usually accompanied by severe headache and vomiting, and some by necrotic local lesions.

Climate.

Fanning Island has almost no seasonal variations, and when they occur they are slight in amount. There is a comparatively short "dry" season between September and January, but even then there may occasionally be heavy rain. The climate is uniform during the whole year. In 1946 the mean temperature was 85.5° F., the absolute minimum temperature 71° F., and the absolute maximum

TABLE II.

Month.	Barometer Reading. (Inches.)	
	Maximum.	Minimum.
January	30.114	30.008
February	30.113	30.012
March	30.102	29.976
April	30.161	30.054
May	30.145	30.060
June	30.162	30.011
July	30.131	30.009
August	30.175	30.000
September	30.114	30.020
October	30.132	29.998
November	30.133	29.970
December	30.104	29.964

100° F. (a record). Table I shows the monthly variation of maximum and minimum temperatures (dry bulb thermometer) in 1946, as recorded by me at the meteorological station of Cable and Wireless, Limited.

The barometer shows steady readings throughout the year. Table II shows the maximum and minimum readings in 1946.

The prevailing winds are east and south-east, though the north-east wind is fairly common in the period from March to June and the south wind in the period September to October.

TABLE I.

Temperature.	Month.											
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.
Maximum ..	92° F.	95° F.	92° F.	92° F.	92° F.	92° F.	93° F.	92° F.	96° F.	100° F.	96° F.	95° F.
Minimum ..	75° F.	75° F.	74° F.	74° F.	74° F.	75° F.	75° F.	75° F.	74° F.	77° F.	71° F.	73° F.

TABLE III.
The Prevailing Winds in 1945 and 1946. Number of Days per Month in which Direction of a Wind was Recorded at 9 a.m. Standard Time.

Month.	North-east.		East.		South-east.		South.		South-west.	
	1945	1946	1945	1946	1945	1946	1945	1946	1945	1946
I	0	5	3	7	26	19	0	0	0	0
II	4	6	3	7	21	15	0	0	0	0
III	25	17	4	6	2	8	0	0	0	0
IV	20	22	4	4	6	4	0	0	0	0
V	15	10	7	9	9	12	0	0	0	0
VI	12	6	2	12	16	11	0	1	0	0
VII	3	3	2	2	26	20	0	4	0	2
VIII	1	0	1	7	29	23	0	1	0	0
IX	1	0	0	1	29	17	0	12	0	0
X	1	0	0	2	26	24	1	5	3	0
XI	0	1	0	2	30	20	0	7	0	0
XII	1	0	7	3	23	25	0	3	0	0
Yearly total ..	83	70	35	62	243	198	1	33	3	2

As can be seen from Table III, Fanning Island lies in the area of the south-east trade wind, which blows a more or less steady cool breeze day and night.

The annual rainfall in 1946, as taken by the gauge at the cable station, was 70.80 inches.

The monthly amounts of rain and the number of rainy days in 1946 are as shown in Table IV.

TABLE IV.

Months.	Rainfall in Inches.	Number of Rainy Days.	Months.	Rainfall in Inches.	Number of Rainy Days.
January ..	6.43	19	July ..	12.31	20
February ..	2.59	13	August ..	6.22	22
March ..	9.23	29	September ..	0.44	8
April ..	8.41	23	October ..	0.38	7
May ..	7.84	27	November ..	5.97	10
June ..	10.61	22	December ..	0.37	6
Yearly total ..	70.80	206			

The average monthly rainfall over a period of twenty years (1909-1912, 1915, 1917, 1922-1925, and 1928-1937) at Fanning Island, as reported by the Bureau of Meteorology, Commonwealth of Australia,⁽¹⁾ was as shown in Table V.

The mean relative humidity, as recorded at the cable station in 1935, 1936 and 1937, was as shown in Table VI.⁽²⁾

In 1946 the maximum relative humidity was 95% (during twelve days) and the minimum 65% (during three days).

TABLE V.

Month.	Rainfall (Inches.)	Month.	Rainfall (Inches.)
January ..	7.31	July ..	7.28
February ..	9.12	August ..	3.61
March ..	10.44	September ..	2.94
April ..	11.33	October ..	2.62
May ..	11.31	November ..	2.43
June ..	9.95	December ..	5.88
Yearly ..	84.22		

Table VII shows the number of days per month when the relative humidity was over 90%.

It is surprising that the very high relative humidity at Fanning Island is so well tolerated; but this is due to the trade winds.

I have lived for many years in different parts of British India and Ceylon and know how difficult it is there to

tolerate a relative humidity of over 80% to 85%. In Bombay, where the climate is hot and humid (except in December-January), it is difficult to escape sweating even under a fan. At Fanning Island no fans are installed, as the trade wind seldom fails to make its daily visit to the island. It would probably be difficult to find another place in the tropics where the climatic environment is more ideal for a white man than at Fanning Island.

TABLE VI.

Month.	Relative Humidity (Percentage.)			Month.	Relative Humidity (Percentage.)		
	1935	1936	1937		1935	1936	1937
I	77	78	75	VII ..	77	79	78
II	77	77	73	VIII ..	75	71	72
III	79	79	72	IX ..	75	67	70
IV	83	84	79	X ..	67	70	66
V	79	80	76	XI ..	67	70	65
VI	77	77	78	XII ..	75	72	74
Yearly average ..	76	75	73				

The sky is seldom cloudless at Fanning Island. Patches of clouds are always present over the island, and when they are thick enough their colour is deep green, the result of reflection of the colour of the water in the lagoon.

The colour of the water in the lagoon varies from deep blue in the centre to cobalt-blue and green in shallow parts.

TABLE VII.

Month.	Number of Days.	Month.	Number of Days.
I	6	VII ..	4
II	3	VIII ..	2
III	8	IX ..	1
IV	9	X ..	0
V	3	XI ..	2
VI	4	XII ..	0
Total ..	42		

The greenish clouds over the island are easily seen at sea, sometimes before the island itself can be seen from the approaching ship, and in the old days these coloured clouds served as a beacon to a lonely ship out at sea.

Thunder and lightning are very rare; real storms are unknown. Amongst other phenomena the appearance of tidal waves has been noted occasionally; but, having originated in the northern parts of the Pacific, tidal waves

have never done any great damage to this island. The last tidal wave, which inflicted great damage in Hawaii in 1946, caused no damage at Fanning Island, though its sweep was felt. The tidal wave arrived at Fanning Island about midnight on the night between March 31 and April 1, when the residents were awakened by the abnormal surf noise. On inspection next morning it was found that the beach was scoured out almost to the crest.⁽⁴⁾

At low tide, about noon, reef and cables were exposed to about 60 yards to seaward. A long, slow surge was coming in from this low level to more than half-tide level, taking about three minutes from the lowest to the highest points. The surge and phenomenal rise was still evident at 6 p.m. The ocean appeared to be normal by the next morning.

It is interesting to note that this tidal wave was not felt at Christmas Island, which is only about 153 nautical miles to the south-east of Fanning Island. The commander of the United States Army Ship FS 291, which arrived at



FIGURE VII.
Gilbertese girls.

Fanning Island about 11 a.m. on April 2 and had left Christmas Island at 6.30 p.m. on April 1, reported that nothing unusual was observed by him either at Christmas Island or en route to Christmas Island from Canton Island.

Water Supply.

There is plenty of subsoil water to be found at Fanning Island. It is usually present from two to five feet below

TABLE VIII.

Chemical Characters.	Parts per 100,000. (For Equivalent in Grains per Imperial Gallon, Multiply by 0.7.)
Total solid residue	112.40
Chlorine present as chloride	39.00
Nitrogen present as free and saline ammonia	0.001
Nitrogen present as organic ammonia	0.024
Nitrogen present as nitrate	0.005
Oxygen absorbed in fifteen minutes	0.144
Oxygen absorbed in four hours	0.310
Total hardness calculated as calcium carbonate	68.00
Permanent hardness calculated as calcium carbonate	31.00
Alkalinity calculated as calcium carbonate	37.00
Metallic contamination	Small amount of iron

the surface. But its quality varies in the "wet" and "dry" seasons, and even when it is good it is seldom used for drinking.

Luckily the yearly seventy inches of rain make the problem of drinkable water rather an easy one at Fanning Island. The rain water is palatable and is used unboiled by the population of the island for drinking.

The catchment areas for rain water are roofs of houses, and the water is stored in tanks, some wooden, but mostly iron, and no ill effects of this water on the population have yet been noticed.

There are also an emergency cement cistern in the cable station compound with a capacity of about 70,000 gallons, and two smaller cisterns in the area occupied by the district officer and his staff.

The well water is hard at Fanning Island, and the following analysis is of interest (Table VIII):⁽⁵⁾

This water is very hard, but, judging from the chemical analysis, there is no evidence of pollution. It contains a considerable amount of sulphates, which at times would probably give rise to small amounts of sulphuretted hydrogen.

The closer a well is situated to the ocean or lagoon shore, the more profuse is the water supply, as this is the sea water which at high tide percolates through the sand and corals into the island. After a heavy rainfall, the water in such a well is fresh and potable for some time, as the rain water and the sea water are not easily mixed together owing to the difference in their specific gravities. But if the rainfall is not heavy enough, the



FIGURE VIII.
Numerous "umbrella" trees in the bush.

influx of percolated sea water is greater than that of rain water, and the water in the well quickly becomes brackish and hard again.

The water in the centre of the island is fresher, especially during the wet season, when about seventy inches of rain falls at Fanning Island. The rain water accumulates more readily in the subsoil, and lies in the depressions of the compact breccia platform, which is the basis of each coral atoll.⁽⁶⁾

My experiments with subsoil water in the middle of the island show that the level of the water in a well situated about 800 feet from the ocean beach and about 850 feet from the lagoon is still influenced by the movements of the tide. It rises and falls as the tide does, but the variation of high and low levels does not exceed two inches in twenty-four hours. The water in this well was only two and a half feet from the surface when the well was dug. The subsoil consists entirely of sand and coral fragments.

It is interesting to note that the influence of rain water in this well is much greater than in those situated closer to beaches. After heavy rain the influx of rain water into this well from the subsoil is noticeable. But if there is no rain for several days, the highest point of the level gradually falls. This proves that the water found in a well situated in the centre of an atoll with a heavy rainfall is mostly rain water, collected in the depressions of the compact platform; this fact was also observed by Dr. F. Wood Jones at Keeling and Cocos Islands.

Population.

With the exception of a few persons born at Fanning Island, whose ancestors settled down on this island some ninety years ago, there is no permanent population. The

floating population consists of Gilbert Islands workmen engaged by Fanning Island Plantations, Limited, some Chinese engaged by the cable station, and a small colony of Europeans who come to Fanning Island mostly for a two years' term.

On December 31, 1946, both males and females being counted, there were 20 Europeans, 27 Chinese, 170 natives and seven persons of mixed parentage. The places of origin of the Gilbertese labourers are Beru, Nonouti and Onotoa Islands, Gilbert group.

There were seven births during 1946 and one death (native labourer; heart-failure).

Table IX shows the census of population at Fanning Island on December 31, 1946.

TABLE IX.

Population.	English Harbour Area.	Napai.		Total.
		Cable Station.	District Officer's Area.	
Natives:				
Men	87	0	8	95
Women .. .	24	0	9	33
Boys	14	0	12	26
Girls	8	0	8	16
Mixed:				
Men	2	0	0	2
Women .. .	3	0	0	3
Boys	1	0	0	1
Girls	1	0	0	1
Chinese:				
Men	0	21	0	21
Women .. .	0	1	0	1
Boys	0	3	0	3
Girls	0	2	0	2
Europeans:				
Men	1	9	1	11
Women .. .	1	3	1	5
Boys	0	1	0	1
Girls	2	1	0	3
Total	144	41	39	224

The Food Problem.

The food problem in the tropics has always been and still is serious. It is the question not only of how to preserve food from quick deterioration, but also of seeing that a sufficient variety of food is available, otherwise it soon becomes monotonous and unappetizing.

At Fanning Island the problem of keeping imported food such as meat, butter and eggs is solved by the refrigeration plant, maintained by the cable station. Still, I have noticed on a few occasions that after approximately three months a good part of the meat left in the freezer has become mouldy. At Fanning Island mould is everywhere—on trees, on soil and of course in the air. The meat can be easily contaminated by the persons who handle and cut it. But there is also a gap of at least one hour between the time when frozen meat leaves a ship's refrigerator and its arrival in the company's refrigerator. During this time the bags of meat are exposed to the tropical conditions, as they have to be carried in an open launch and an open motor truck, the only vehicle available.

Before the war with Japan, the cable station regularly received a three months' supply of meat and butter. A ship called at Fanning Island from Honolulu every three months and some fresh vegetables and fruits also were brought in. But during the war this ship was taken over by the American navy, and the population, as well as the American garrison at Fanning Island, were well served by the United States Army ships. Since the American garrison's departure from the island in July, 1945, the problem of getting supplies from Australia and New Zealand has been complicated by the shortage of ships

available in the Pacific and by the post-war wave of strikes in both countries.

The cable station also maintains an ice plant, and every house in its area is supplied daily with ice, so food is kept in ice-boxes. Two houses also have a kerosene refrigerator.

Not a great variety of food is available at Fanning Island, and when meat becomes scarce the population has to depend on canned food and local fish. The position would not be so bad if fish were easily obtained. Though



FIGURE IX.
On the lagoon shore.

there is plenty of fish in the ocean and in the lagoon, more often than not it is hard to get it ashore. Also it is not always safe to eat each fish caught, and numerous cases of fish poisoning at Fanning Island are proof of this.

These difficulties could be easily overcome if "greens" were available at Fanning Island all the year round, and in sufficient quantity for the population. But the shortage of labour and the absence of a permanent population who could grow them give no chance as yet of solving this



FIGURE X.
Eastern side of the island. View to north-east.

very important problem. A small vegetable garden for the staff of the cable station cannot cope with the demand.

It has already been proved by a few persons that almost any vegetable could be grown at Fanning Island if the labour was made available. The following thrive well: beans, silver beet, cabbage (Chinese and English), cucumber, tomatoes, sweet potatoes, lettuce, pumpkin, squash, melons (rock and water), spring onions, radish, mint and soup celery. *Papaya* (papaw) grows easily and well in all parts of the island, but bananas require

more care and supervision. No other native fruits are grown at Fanning Island, though there are a few fruit-bearing mango trees in the English Harbour area; but the fruit is very fibrous. There are also a few bread-fruit trees.

Canned milk is imported either from Australia or from the United States of America, but as its price is rather high, only Europeans can afford to use it regularly.

The observations of McCay, Castellani and others in the tropics seem to indicate that a protein intake greater than normal is necessary for the maintenance of good health in the tropics, though some authorities, as for example Chittenden,⁽¹⁰⁾ are of the opinion that a low



FIGURE XI.
Natives.

protein diet is advisable. The diet of the native labourers at Fanning Island seems to be low in protein content, though its caloric value is sufficiently high.

The general health condition of labourers at Fanning Island is good. As a rule they are well built, physically strong persons. However, one thing has been noticed—that once decay has started in a tooth, it is apt to produce very quickly the formation of a carious cavity. It is quite possible that a high carbohydrate intake in the diet of labourers is responsible for this phenomenon.

Table X shows the ration scale for the labourers of Fanning Island Plantations, Limited.

TABLE X.
Ration Scale per Man per Week.

Name of Product.	Quantity.	Approximate Caloric Value.	Remarks.
Rice	7 pounds.	11,200	Mostly polished.
Biscuits	7 pounds.	13,300	Plain.
Flour	11 pounds.	18,000	White.
Tinned meat	7 pounds.	8,900	Corned beef.
or			
Fresh fish	10 pounds.	3,000	
Sugar	1.75 pounds.	3,000	Brown.
Salt	2 ounces.		
Soap	4 ounces.		

The caloric value is as follows:

Total maximum, when flour and meat are included	41,100
Daily maximum	5,870
Total minimum, when biscuits and fresh fish are included instead	30,500
Daily minimum	4,357

However, the whole ration is not consumed. A good part of the rice, biscuits, flour and tinned meat is stored by the natives, who take the saved ration back to their islands, after serving a two years' term at Fanning Island.

As for Europeans at Fanning Island, their general health is fairly good; but the absence of fresh fruits (except papaw) and the shortage of fresh vegetables are responsible for common constipation. It has also been noticed that amongst Europeans and Chinese a shortage of butter produces an increased number of skin disorders, especially when "greens" are also scarce. Cases of eczema then become common. That this is solely due to vitamin A deficiency is proved by the fact that, when butter becomes available again and can be used liberally, the number of skin lesions drops considerably in a short time.

Still, the majority of Europeans at Fanning Island maintain their weight approximately at the usual level, and some have even gained in weight by the time they leave the island after a two years' term.

Both European and native children find conditions at Fanning Island really ideal. They grow and develop normally and are healthy on an island free from infectious diseases.

Housing.

Climatic adaptation in the tropics is most essential for the good health of a white population, and the housing problem, properly solved, is the foundation of well-being.

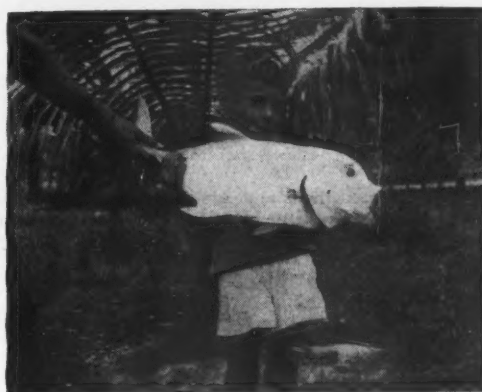


FIGURE XII.
Twelve pounds white paithere, caught in the lagoon.

The houses for Europeans at Fanning Island are satisfactory. The buildings are constructed in such a way as to allow the maximum amount of shade and air circulation and to exclude the greatest amount of heat.

The plan (Figure XV) of the medical officer's bungalow shows that this problem has been solved fairly well. A desirable improvement to this plan would be wider verandas. They should be at least ten feet wide; this would tend to make the central rooms considerably cooler. It would also make them more comfortable as sleeping places. All doors to the rooms are wide and are usually kept open day and night.

There are also two buildings in the cable station area in which the rooms are arranged in a single row with open verandas on all sides of the building. They are the "office block" and the "bachelors' quarters". These buildings are probably amongst the coolest on the island.

The natives live in wooden barracks, elevated two or three feet above the ground, to permit a free circulation of air beneath them. Still, unless these barracks are situated under trees, they are hot during the day. Double-roofed huts would be much cooler, especially if at least the outside roof was made from native thatch.

All the houses occupied by Europeans have water laid on and are connected to a sewage system. The sewage is discharged into the ocean. For natives the toilets are built some distance out from the shores of the ocean and the lagoon. They are sufficiently elevated over high tide level, and are kept clean.

In view of the presence of *Aedes scutellaris* at Fanning Island, it is advisable to rest during the daytime and to sleep at night under a mosquito net.

Recreation Facilities and Their Importance.

At Fanning Island facilities for the following recreations are available: tennis, billiards, swimming (in a small ocean pool) and fishing.

There are a few well-laid roads at Fanning Island, built during the occupation of the island between 1939



FIGURE XIII.

L-shaped corner-stone, sixteenth century ruins.

and 1945 by New Zealand and American troops. I would advise newcomers to bring bicycles with them, and then many interesting parts of the island can be easily visited.

There is also a library at the cable station, and a few periodicals, mainly American, are available for the members of the colony. Unfortunately ships call at Fanning Island irregularly, and both mail and journals are often received after a considerable delay.

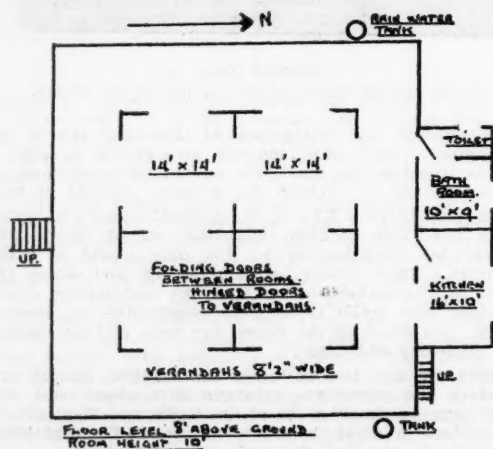


FIGURE XIV.

Plan of medical officer's house.

Life at such a small island as Fanning, with its tropical climate and limited population, is monotonous and lacking in stimulating effects. Opportunities for recreation are rather limited, and failure to take regular exercise, coupled with the enforced separation of some married men from their families, is frequently responsible for physical as well as mental depression.

From my personal observations in a few small tropical stations, I am absolutely convinced that married men

should be posted to such a place as Fanning Island only if their families can accompany them.

It is most advisable that a certain amount of daily exercise should be taken regularly, whether it be tennis, swimming, fishing or walking. Gardening should be an ideal form of exercise for those who are physically strong enough to stand tropical conditions. It could be also a pleasant form of "recreation" if labour was available.

It has also been found that such social events as picnics and musical evenings have a stimulating effect on a small social group.

If more funds were made available for recreation, and with better equipment, including a cinematograph outfit, life at Fanning Island could be made easier and more pleasant.

Acknowledgements.

My thanks are due to Mr. A. J. Black for drawing the map of Fanning Island and the plan of the medical officer's bungalow, and to Mr. H. Clark for his painstaking reading and correction of the manuscript.

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Reports of Cases.

A CAROTID BODY TUMOUR.

By NORMAN WYNDHAM,
Sydney.

TUMOURS of the carotid body are not common. The subject has been reviewed competently by H. M. Goldberg (1947) in a recent issue of *The British Journal of Surgery*. The man whose case is reported here sought advice because of a painful swelling of the neck. This is an unusual symptom. So closely did the lesion simulate a cervical lymphadenitis that its recording is considered justifiable.

The patient was a man, aged fifty-six years, a big, healthy-looking individual, who had served in both world wars. In June, 1945, he had an attack of giddiness, falling over in his tent. He did not lose consciousness, but was rather giddy for several hours. He did not suffer from headache or from any disturbance of his cardio-vascular system, apart from this one attack of vertigo. There was no evidence of impaired renal function. Since the blood pressure was 160 millimetres of mercury (systolic) and

100 millimetres (diastolic), he was "boarded out" of the army, having commanded a combatant unit up to that time.

Six weeks after his attack of giddiness—that is, at the end of July, 1945—he was examined by a surgeon, who reported an enlargement of a lymph node at the anterior border of the sternomastoid muscle in the left carotid triangle. The swelling was symptomless, firm and not tender. His blood pressure was then 140 millimetres of mercury (systolic) and 95 millimetres (diastolic).

He was first examined by me in March, 1946, when he complained of pain in the region of the cervical swelling. In every other way he felt well. There had been no recurrence of the giddiness. On examination, slight reddening of the skin was observed over an oval swelling two and a half inches by one and a half inches in area situated at the lower angle of the left carotid triangle. The tumour was tender but firm, and mobile in an antero-posterior direction only. There was no other sign of organic disease. The blood pressure was 170 millimetres

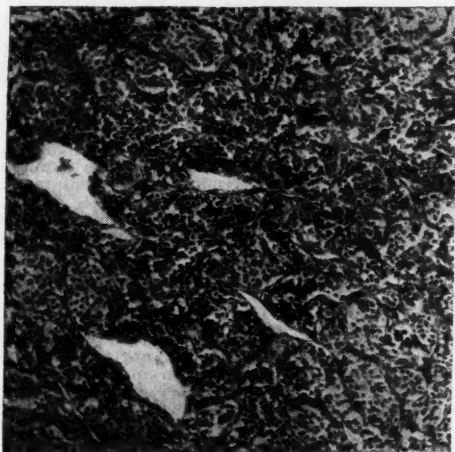


FIGURE I.

of mercury (systolic) and 100 millimetres (diastolic). The provisional diagnosis was exacerbation of inflammation in tuberculous lymphadenitis. Carotid body tumour was not even considered.

An operation was advised. This was performed on April 29, 1946. A swelling, of the size indicated above, was found in the angle formed by the bifurcation of the left common carotid artery. The outstanding feature—which is a common finding—was the vascularity of the capsule. In the early stages of the dissection the condition was thought to be some type of arterio-venous aneurysm or cavernous angioma. This capsule was fascial and not part of the tumour, so that the latter could be dissected free from it without difficulty. At no time did it appear as though the carotid vessels would require ligation. It was considered desirable to spend some time in painstaking dissection rather than to imperil the cerebral blood supply in a man of the patient's age.

Post-operative convalescence was uneventful. There was no disturbance of the vasomotor mechanism. However, he was examined by me on February 5, 1947, when the left cheek was more flushed than the right. He felt well. His blood pressure was the same as before operation. He had no recurrence of giddiness.

The histological appearance of the gland, as seen in Figure I, presents no unusual features. The cells are small and round with a homogeneous cytoplasm and a relatively large round nucleus in which the chromatin appears as fine granules. The cells run in columns in a vague way, sometimes appearing as sheets of cells, sometimes showing a tendency to surround a lumen. The regular uniform appearance of the cells is a feature. In

parts the connective tissue is in broad bands containing collagenous fibres, but mostly it is in fine reticular strands from a network amongst the parenchymal cells. There is an intact, distinct capsule, devoid of the vascularity so pronounced in the surrounding fascia. Some large vessels are to be seen in the sections.

Comment.

Attention is drawn to the history of an attack of giddiness unassociated with any obvious sign of organic disease and to the painful swelling simulating cervical lymphadenitis.

Bibliography.

H. M. Goldberg: "Carotid Body Tumours", *The British Journal of Surgery*, January, 1947, page 295.

Reviews.

A YEAR BOOK OF INDUSTRIAL AND ORTHOPÆDIC SURGERY.

THE publishing of "The 1946 Year Book of Industrial and Orthopedic Surgery" ends a phase in the development of this member of the series. Among the 1947 volumes it is to appear as a "Year Book of Orthopedics and Traumatic Surgery" under the editorship of Edward L. Compere, Associate Professor of Surgery, Northwestern University Medical School. The 1946 Year Book was edited by Charles F. Painter, who had been responsible for all of its predecessors, and who had just completed the present volume before his death in January, 1947. The volume is dedicated to him by the publishers and contains a portrait and an obituary, which pays him unstinted tribute.

Most of the year book is devoted to orthopedic surgery, only the concluding 33 pages (of a total of 414) being concerned with industrial medicine. The orthopedic section deals with arthritis and rheumatism, osteomyelitis and other infections, tuberculosis, poliomyelitis, tumours, fractures, dislocations and sprains, lesions of each main section of the skeletal system, surgical technique and a miscellaneous section. Interesting papers summarized in the first subsection deal with the occurrence of arthritis and allied conditions in tropical diseases, characteristic vascular patterns found in patients suffering from rheumatoid arthritis, and the frequency of unequal length of legs as a cause of backache. The use of penicillin in the treatment of osteomyelitis receives attention from authors on both sides of the Atlantic; its value in the acute disease is well substantiated; opinions of its value in the chronic phase are not so unanimous, though good results have been obtained by its use alone or in conjunction with surgery. In this subsection on infections, reference is made to a report by Joan A. Marsden, of Melbourne, on the treatment of tendon sheath infections with penicillin. A long abstract with many X-ray photographs illustrating the differential diagnosis of tuberculosis of joints opens the section on tuberculosis; another article considers the diagnostic value of examination of the gastric contents. Among the papers on poliomyelitis there are a good many references to the Kenny treatment, both for and against. A report is also included on an epidemic of poliomyelitis among troops in the Middle East by J. E. Caughey and W. M. Porteous, of New Zealand. Many articles on tumours have been abstracted; one is noted which draws attention to the development of squamous cell carcinoma in the sinus tracts of chronic osteomyelitis. The range of papers reviewed in the general parts of the book is too great to allow of selection; the editor has drawn widely from American, English, Continental and Australian journals, and has included an article by L. J. A. Farr and Eva Shipton on *spondylitis ankylopoietica* and a report by Thomas F. Rose of bilateral trigger thumb occurring in infants.

The section on industrial medicine, though short, contains some interesting material. The opening group of papers deal with general problems, opinion from both England and America agreeing on the importance of early restoration of patients to some worthwhile form of activity if they are to be successfully rehabilitated after industrial injuries. A subsection on toxicology refers to various toxic agents which

¹ "The 1946 Year Book of Industrial and Orthopedic Surgery", edited by Charles F. Painter, M.D.; 1947. Chicago: The Year Book Publishers, Incorporated. 7" x 4½", pp. 432, with many illustrations. Price: \$3.75.

affect workers in industry. The final subsection on specific hazards refers to occupational affections of the lungs and skin and, in a series of abstracts, to the ill-effects occurring among workers with pneumatic vibratory tools and their management.

This is altogether an interesting and comprehensive volume. A few minor errors were noted, such as references on pages 278 and 305 to the Royal Infirmary and Children's Hospital, Sunderland, the first reference placing it in Australia, the second in England, and the omission of the name of Thomas F. Rose from the index of authors. However, the production of the book is generally of a high standard, it is quite profusely illustrated with useful X-ray photographs and diagrams, and should appeal to a wide circle of readers.

THE CARE OF CHILDREN FROM ONE TO FIVE.

"THE CARE OF CHILDREN: FROM ONE TO FIVE", by Dr. John Gibbens, now in its third edition, has evidently been a popular handbook for mothers and nurses in England since it first appeared in 1936.¹

In the brief space of 178 pages the writer endeavours to cover almost every aspect of child care and training. Food values, sample diets, clothing, posture, speech development, care of eyes and teeth, first aid, the common diseases of childhood are all mentioned, as well as many of the common behaviour problems.

In the writer's preface he remarks on the style of writing used throughout, particularly the use of the second person and the imperative, which, as he states, is vivid and strikes home, and every mother will meet it when she goes to her doctor for advice. While this may be true, it should be remembered that a mother receives advice usually on one subject at a time, which is totally different in effect from reading a book in which advice is attempted on practically everything to do with children. Explicit instructions are all very well if they are few, but a non-stop barrage of dogmatic edicts tends to leave the reader in a somewhat battered mental condition.

Generally speaking, the reasons for the numerous instructions given are sound; but many would protest against the suggestion that some children are born "inherently vicious" and that abnormal behaviour is not always due to bad parents, bad training or bad environment.

The book has been written primarily with English social customs and climatic conditions in mind. These, of course, differ greatly from our own more fortunate physical circumstances, so that a number of the points raised are not applicable in the same manner to Australian children who have a free outdoor life all the year round. It is also interesting to compare the graphs of average height and weight with the New South Wales figures.

SYPHILIS.

In the second edition of "Essentials of Syphilology" by Rudolph H. Kampmeier,² the pages are fewer but larger than in the first. An extra chapter, dealing with the intensive treatment of early syphilis, has been added and the general excellence of the first edition has been maintained.

In regard to intensive methods of treatment, the author warns his readers that they are still experimental and that, to his knowledge, their medico-legal status has not yet been tested. The intensive methods considered are the intravenous drip (slow and rapid), multiple injections, and fever and arsenotherapy combined.

Neocarsphenamine, he states, has no place in intensive treatment because of the great amount of metallic arsenic involved. The arsenoxide is the arsenical of choice. Intensive procedures are applicable only in early syphilis, or in latent syphilis of less than one year's duration, and their use presupposes hospitalization with skilled attention. In spite of all precautions such methods carry a higher hazard rate. Kampmeier claims that the increased hazards of intensive treatment must be balanced against the morbidity and

mortality of late syphilis, and of congenital syphilis, due to failure to receive adequate treatment by usual routine methods, because of default. The intensive, or short term, courses tend to decrease the incidence of infectious relapse and so the public health results are of inestimable value.

The use of penicillin in syphilis is mentioned very briefly, the author claiming that at the time of writing it was too early to set down any definite conclusions. In a later edition it is probable that the reference to penicillin will be considerably expanded, for much information is now available in advance of what is contained in this edition. Time alone can set the seal of approval so far as the efficiency of penicillin in the treatment of syphilis is concerned, and the period of observation must extend over many years, though we may have a very definite idea of the general trend of results much earlier.

The section dealing with the serological diagnosis of syphilis gives useful guidance and warns practitioners against a diagnosis of syphilis on the basis of a positive report on one blood sample without supporting clinical or collateral evidence. Diseases which may cause biological false-positive reactions are discussed, and mention is made of the small number of normal individuals who will be found to have positive reactions, especially in regard to flocculation tests. The more sensitive the tests are made, the greater will be the number of such false-positive reactions. Attention is drawn to false-negative results which occur not only in late latency, but also in the active process of late syphilis. Possibly 5% to 10% of active late benign lesions may be associated with negative blood findings.

The doubtful reaction in a presumably non-syphilitic person presents a difficulty, and a proper evaluation depends on the physician's clinical judgement and experience. Kampmeier wonders "how many unfortunates annually are started on the road of anti-syphilitic treatment merely on a report of a doubtful blood test".

Treatment with arsenicals and bismuth, mercury, iodides, and fever therapy is dealt with in sufficient detail to cover all needs.

The invasion by the *Treponema pallidum* is followed stage by stage and the multiplicity of clinical pictures possible in the host as a result of such invasion are considered one by one.

Early infection diagnosed and brought under efficient control ceases to be a menace, but neglect or failure to appreciate the presence of infection means disaster in a high percentage of cases. Cardio-vascular syphilis, with aortitis, aortic insufficiency or aneurysm, is surveyed and prognosis is considered. It is thought that the outlook of aortitis should be good under treatment, and it is with the hope of preventing the late manifestations of cardiovascular disease that treatment is strongly urged for late latent syphilitic patients.

It is believed that many patients in the stage of late latency have aortitis and "it is impossible to forecast what percentage of the cases will progress to develop the complications of aortic incompetency or aneurysm". The complications of syphilitic aortitis are more frequent in the Negro race in America, and it is thought probable that the higher incidence of heavy labour in that race is a potent factor in the development of such complications. In regard to syphilis of the central nervous system, the author thinks it probable that the invasion by the *Treponema pallidum* occurs early in the course of infection, and it has been found that apparently normal spinal fluid may contain treponemata. Neuraxis invasion takes place within the first four years of infection, and it is stated that it is generally accepted that neurosyphilis is extremely unlikely to develop if the spinal fluid is "negative" four years following infection. The author believes that the spinal fluid examination should be carried out in early syphilis some time between one year after the commencement of treatment and its conclusion; or if serological fastness is present, six months after adequate treatment in early syphilis (as serological fastness beyond this time is most often due to neurosyphilis); or in the event of serorelapse in any case of early syphilis; or as part of the diagnostic survey, unless contraindicated, in every case of late syphilis and in the management of neurosyphilis.

The chapters dealing with syphilis and pregnancy, and with congenital syphilis, contain much useful information, though no mention is made of the use of penicillin in these fields.

This volume may be recommended to those who wish a brief well-planned practical guide to the diagnosis and treatment of syphilis. Too many medical practitioners claim that they never, or rarely ever, see syphilis today. If they will take the trouble to modernize their knowledge by reading a book such as this they may begin to wonder how much syphilis they have failed to recognize.

¹ "The Care of Children: From One to Five", by John Gibbens, M.B. (Cambridge), M.R.C.P. (London); Third Edition; 1947. London: J. and A. Churchill, Limited. 7½" x 4", pp. 202. Price: 5s.

² "Essentials of Syphilology", by Rudolph H. Kampmeier, A.B. M.D., with chapters by Alvin E. Keller, M.D., and J. Cyril Peterson, M.D.; Second Edition; 1946. Oxford: Blackwell Scientific Publications, Limited. 8½" x 5½", pp. 465, with many illustrations. Price: 25s.

The Medical Journal of Australia

SATURDAY, NOVEMBER 1, 1947.

All articles submitted for publication in this journal should be typed with double or treble spacing. Carbon copies should not be sent. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

References to articles and books should be carefully checked. In a reference the following information should be given without abbreviation: initials of author, surname of author, full title of article, name of journal, volume, full date (month, day and year), number of the first page of the article. If a reference is made to an abstract of a paper, the name of the original journal, together with that of the journal in which the abstract has appeared, should be given with full date in each instance.

Authors who are not accustomed to preparing drawings or photographic prints for reproduction are invited to seek the advice of the Editor.

STREPTOMYCIN.

THE fact that powerful antibacterial substances can be isolated from soil bacteria, fungi and other sources and used successfully in the treatment of disease, has been described as the most startling paradox of modern medicine. Bacteriologists have always known that the growth of one microorganism might be inhibited by the growth of another, and conjectures have often been made on the possible bearing that this phenomenon might have on therapeutics. We read in "Topley and Wilson" that the application of these natural bactericidal or bacteriostatic substances to the treatment of infections was usually limited by the low therapeutic index of the materials available—the doses tolerated by the animal were ineffective against the infecting organism. Some organisms are concerned with specific functions such as the fixation of nitrogen, and processes of this kind have been described as taking place in chain-like reactions in which one organism acts on the products of another. It is easy to understand in all these circumstances how antibiotic agents may be said (to quote Hyman's "Integrated Practice of Medicine") to serve the essential function of adapting a particular organism to the complexities of its environment. It is also easy to understand how certain antibacterial substances produced in artificial media and extracted in potent and relatively pure form may be of the greatest use in the treatment of disease.

The antibiotic substances which exist in nature are innumerable, and many have been isolated and studied. In the latest edition of "Topley and Wilson" the following substances are listed: (a) from bacterial sources—tyrothricin, yielding tyrocidin and gramicidin; (b) from moulds—actinomycin, actinomycin A and B, aspergillol, citrinin, clavacin, flavicin, fumigacin, fumigatin, gigantol, gliotoxin, helvolic acid, penatin, penicidin, penicillol, penicillin, proactinomycin, spinulosin, streptomycin, streptothricin and miscellaneous mould products. Of these, penicillin, tyrothricin and streptomycin are the best known. Penicillin, in everyday use, has been discussed for the past year or two in this and all

other medical journals and need not be referred to further here. Streptomycin is gradually becoming available for clinical use, and it is important, with the scarcity of the drug and its high cost, that it should be used with a full understanding of its capabilities and its limitations.

Streptomycin was first described by A. Schatz, E. Bugie and S. A. Waksman in 1944. As a matter of fact, it was one of two compounds isolated from artificial media containing cultures of soil organisms of the genus *Actinomyces*. The two compounds, streptothricin and streptomycin, isolated respectively from cultures of *Actinomyces lavendulae* and *Actinomyces griseus*, are specially noteworthy because, unlike penicillin and tyrothricin, they display a bacteriostatic effect against Gram-negative organisms. Beaumont and Dodds point out in the twelfth edition of "Recent Advances in Medicine" that a close similarity exists between the two compounds, not only in the mode of extraction, but also in chemical properties. Streptothricin and streptomycin are basic compounds soluble in water and in dilute mineral acids, but insoluble in most organic solvents. They are precipitated by protein reagents, but do not give normal protein colour reactions, and they are not inactivated by incubation with proteolytic enzymes. Streptothricin is not suitable for systemic use, but streptomycin is sufficiently free of toxic properties to be administered by any of the normal routes. Beaumont and Dodds point out that as a water-soluble substance streptomycin gains ready access to most body tissues. This property unfortunately is responsible for its rapid elimination by the kidneys. As in the case of penicillin, a therapeutic concentration in the blood can be maintained only by a continuous intravenous drip. Large doses may be given by the intramuscular or by the subcutaneous route with little or no evidence of toxicity. The conditions in which streptomycin may be used and the organisms against which it is effective, were set out at some length in a statement published in this journal on June 28, 1947. This statement was a report by Dr. Chester S. Keefer to the National Research Council of the United States. It was sent to the Federal Council of the British Medical Association in Australia by the National Health and Medical Research Council and was published at the request of the former body. The statement sets out so clearly what every practitioner should know about streptomycin that it should be preserved by those who still have it in their possession. The National Health and Medical Research Council has not been content to let the matter rest with the acceptance of Dr. Keefer's report. It appointed a Streptomycin Committee, of which Dr. Cotter Harvey, Dr. A. W. Morrow, Dr. K. B. Noad and Dr. W. C. Sawers were members, with Dr. H. W. Wunderly as convener. This committee made certain recommendations to the National Health and Medical Research Council on the use and distribution of streptomycin and these recommendations were accepted by the council. The committee accepted Dr. Keefer's recommendations and it decided that the use of streptomycin in the treatment of pulmonary tuberculosis should be limited to those forms in which experience had shown it to be effective. These forms of the disease are set out in a statement which is published elsewhere in this issue and to which readers are invited to pay special attention. The committee also recommended that each public hospital

and the Repatriation Commission should appoint a committee or an adviser "to decide the cases in which streptomycin may be used". It is not quite clear what this means. The attending clinician should be the person to decide what treatment is to be given; the committee or the adviser should give advice. Probably this is what is intended, for after all the clinician if he is wise will accept advice if it is given by experts actuated by the patient's welfare and by nothing else. In regard to distribution the committee considered what control, if any, could be exercised. It pointed out that all senior Commonwealth medical officers in each capital city and the Repatriation Commission were kept informed of the issue of import licences, of the name of the importing house and of the quantity of streptomycin being given. The committee stated that the authorities in each State had been advised that when streptomycin was required, the necessary information could be obtained from the senior Commonwealth medical officer. It was assumed that the State authorities would pass on information to the public hospitals under their control; the various authorities would then make direct application to the importing house. The committee recommended that the priority of the general hospitals and of the Repatriation Commission should last for a period of two weeks after the arrival in Australia of each batch of streptomycin. It was stated in this journal in the "London Letter" published in the issue of July 5, 1947, that the distribution and use of streptomycin in Great Britain had been placed in the hands of the Medical Research Council. The committee of the National Health and Medical Research Council has recommended that this council shall be granted powers to control the distribution and use of the drug in Australia. If it is made clear that this control is to last only so long as the drug is in short supply and while its use is still as it were in the experimental stage, the recommendation may be accepted as wise.

This short discussion cannot be closed without reference to a recently published symposium¹ prepared under the guest editorship of Dr. Chester S. Keefer. It is not proposed to summarize the individual discussions here as a wide field is covered in considerable detail. The basic conclusions accord with the report already mentioned. The initial paper of the symposium deals with the general properties of the drug and with relevant laboratory procedures; then follow separate considerations of experience in its use in tuberculosis, bacterial endocarditis, peritonitis, wound infections, influenzal meningitis, tularæmia, urinary tract infections and undulant fever; finally its toxicity is discussed. In his editorial Keefer sums up the present status of the drug as follows: "Streptomycin is another antibiotic agent that is extremely valuable and effective in controlling many infections that were uninfluenced by any other existing chemotherapeutic agent." He is impressed with its value in the treatment of tuberculosis, despite the undesirability of drawing early conclusions in this field. The importance is stressed of not neglecting other agents in the treatment of meningitis due to *Hemophilus influenzae*. His final comment on toxicity should be quoted: "On the whole, however, it can be stated that the toxicity is sufficiently low to justify the use of this drug in all serious or potentially serious infections due

to penicillin-resistant, streptomycin-sensitive organisms." Streptomycin should soon be ready to assume a settled place among therapeutic agents.

Current Comment.

VITAMIN C DEFICIENCY SIMULATING ACUTE ABDOMINAL EMERGENCIES.

THE classical signs of scurvy are rarely seen in this country, though there must be a good many individuals who for various reasons receive an inadequate amount of vitamin C. Opinions differ as to the frequency of occurrence and the importance of subclinical scurvy; but it seems worth while to draw attention to three cases, recently reported by Laurence E. Hines of Chicago, of subperitoneal hæmorrhage from vitamin C deficiency, which simulated in its effects acute surgical abdominal conditions.¹ The first instance was in a youth, who was kicked in the abdomen during a football game. Thirty minutes later he vomited and developed pain in the upper part of the abdomen, which steadily increased until it became unbearable. The presence of a ruptured viscus was suspected, and laparotomy performed. An "enormous number" of ecchymotic and petechial hæmorrhages were found, covering almost the entire mesentery, with a few hæmorrhages scattered over the anterior surfaces of the ileum, jejunum and caecum; no other abnormality was present in the abdomen. The ascorbic acid level of the patient's plasma was found to be 0.3 milligramme per centum (normal value is 0.5 to 2.0 milligrammes per centum) and the carrying out of a capillary fragility test on the arm resulted in the appearance of numerous petechiæ. Investigation of the patient's diet showed a very poor intake of foods containing vitamin C. He recovered uneventfully with administration of an adequate diet and ascorbic acid given parenterally. The second patient, a middle-aged man, had pain in the right lower quadrant of the abdomen of spontaneous onset and of four days' duration. He had no nausea or vomiting, but the physical signs were consistent with a diagnosis of acute appendicitis. At operation the greater omentum, thick and indurated, was found adherent to the anterior part of the parietal peritoneum. The parietal subserosa at the site was extensively infiltrated with hæmorrhage and the omentum was thick and purple. Microscopic examination of the omentum revealed fatty tissue with hæmorrhage between fat cells and considerable hyperæmia of the blood vessels. The ascorbic acid level was 0.6 milligramme per centum and a positive result was obtained to the capillary fragility test. The patient seldom ate citrus fruits or vegetables and took from four to ten drinks of whisky each day. The third patient, a woman aged thirty years, had had severe abdominal pain for five hours with vomiting. Physical examination revealed extreme tenderness and board-like rigidity of the abdomen with only occasional peristaltic sounds. Bowel obstruction or perforation of a viscus was suspected; but since ordinary percussion of the chest and palpation of the muscles of the back and extremities revealed great tenderness and because of the lack of leucocytosis, surgical exploration was postponed. Twenty-four hours later signs of tetany appeared. Low levels of vitamin C, calcium, phosphorus and total protein and fatty turbid serum were found on blood examination. Intravenous administration of calcium controlled the muscle pain and spasm, and prompt improvement in clinical and laboratory findings followed administration of an adequate diet supplemented with vitamin C and the B complex, as well as liver extract. The patient was found to be a chronic alcoholic who during a recent debauch had taken no food for several days.

It seems clear that in these three cases, despite other factors present, the clinical condition was essentially due

¹ *The American Journal of Medicine*, May, 1947.

¹ *Surgery, Gynecology and Obstetrics*, August, 1947.

to vitamin C deficiency. Diagnosis of such a state cannot always depend upon the classical clinical findings, but laboratory investigation should reveal it. The effects described are probably too uncommon for the condition to figure prominently in the differential diagnosis of the acute abdominal emergency and it would need to be very firmly established to counterbalance other indications in favour of surgical interference. Just the same, it is as well to know that it does occur.

"ATEBRIN" IN RELATION TO SKIN DISEASE.

Most medical officers who served in malarious zones during the recent war saw skin eruptions which they felt were due to ingestion of "Atebrin". For sound military rather than medical reasons such aetiological opinions were not encouraged. Since the end of the war, however, a good deal has been published on this subject overseas, though not in this country. In an article published in this journal on April 13, 1946, Carl E. M. Gunther expressed the opinion that "Atebrin" was "passing out of the picture". He did not consider that the great success of its war-time use could be repeated in a civilian population during peace, as military discipline was an essential factor in the success achieved, and the risks of toxic effects were justified only by the expediencies of war. When Gunther wrote, the first reports of such toxic effects were just appearing in print, but he suggested that if "Paludrine" turned out as well as it promised, such discussions might profitably be allowed to lapse. It appears that "Paludrine" has proved to be a most valuable drug, and possibly the day of "Atebrin" has largely passed. However, the main points of a few of the many discussions on the subject appearing in the United States are worth recording, if only as a matter of general interest and perhaps to close the subject.

In a paper read at the annual meeting of the American Medical Association in July, 1946, Thomas W. Nisbet has described three groups of cutaneous reactions which, in his opinion, occur following the administration of "Atebrin" (quinacrine hydrochloride).¹ The first is the eczematoid group, which he considers comprises about 80% of the cases; the second consists of the lichenoid reactions about which most has been said and written; the third group is characterized by an exfoliative reaction resembling that due to the arsenobenzols and often accompanied by secondary infection. The only common factor ascertained among those so affected was the ingestion of "Atebrin". As control groups Nisbet cites American prisoners of war in the Philippines and service personnel in tropical but non-malarious areas, neither of which groups received "Atebrin" or manifested the skin reaction; Japanese prisoners of war are thought to be in a similar category, but reliable details are lacking; despite contrary reports Nisbet asserts that the lichenoid types of eruptions were seen amongst troops taking "Atebrin" in the Mediterranean theatre. Further, he quotes examples of contact dermatitis among workers handling "Atebrin". In a discussion which followed Nisbet's paper a series of speakers with varying types of experience supported his views in general, though one quoted a careful investigation which indicated that "quinacrine-caused dermatitis", although a real entity, was not common.

Amongst those who will agree with Nisbet that the prolonged ingestion of "Atebrin" produces toxic skin eruptions in certain subjects, only some will support his view that a large proportion of eczematoid conditions seen among troops in the tropics were of this type. Both in this country and overseas the more generally accepted state is the lichenoid lesion. This has been well described by Herbert S. Alden and Louis J. Frank in a paper read to the American Dermatological Association last year.² It is not necessary to reproduce the detailed description here, but it is that of the condition familiar to many Australian

service medical officers; it is based on the study of sixty cases occurring among men of the Seventh Fleet. From the group examination of 47,990 men serving ashore and taking "Atebrin" routinely and of 3000 men serving at sea and not taking "Atebrin", Alden and Frank obtained the following data. The incidence of lichenoid dermatitis among persons taking "Atebrin" was small—less than 0.6 case per thousand men at a given time. No cases were discovered among the men aboard ship not taking "Atebrin". The eruption occurred only in one instance among men who had been in the South Pacific and taking "Atebrin" for less than six months. The disease occurred among personnel outside the New Guinea-Solomon Islands areas, that is, among those in the Philippine Islands. It was not associated with any evidence of food or vitamin deficiency. It occurred most frequently among persons engaged in combat, but did occur in men on duty far behind the combat zones. Alden and Frank feel that the evidence is overwhelming that "the repeated ingestion of quinacrine hydrochloride in relatively large doses over long periods (approximately 1.0 gramme a week for months) is a major factor in the production of atypical lichenoid dermatitis. However, there appears to be a 'trigger mechanism' in the form of dermal injury, such as contact dermatitis, fungous infections, eczematoid dermatitis and emotional fatigue". They emphasize the fact that this appears to be a drug eruption of the fixed type and should be distinguished from "the acute eruptions due to idiosyncrasy to quinacrine hydrochloride".

The theory of the aetiological significance of "Atebrin" in the lichenoid condition has its opponents, and attention should be drawn to a study of 247 cases by Major M. G. Butler, of the Medical Corps of the Army of the United States.³ Butler, while admitting that "Atebrin" may be "a contributing factor in producing porphyrin bodies which sensitize the skin", is not prepared to accept it as the true cause of the lichenoid state. He suggests as possible alternatives that the eruption is an unusual response to staphylococcal infection of the skin or part of a systemic infection by some unknown infectious agent of limited geographical distribution. He quotes the results of experimental administration of "Atebrin" but the experiments appear to have been far too limited in duration and numbers involved to be of any value. He states that the lichenoid condition was not reported in theatres outside the South-West Pacific zone in which "Atebrin" was used and quotes "a nationally known dermatologist" as authority for excluding cases reported in the Mediterranean zone. It is difficult, however, to explain away the report of six apparently similar cases associated with ingestion of "Atebrin" and reported from the Mediterranean theatre by a fellow officer, Major Lawrence M. Nelson.⁴ Failure to obtain reactions to patch tests is Butler's next argument, but this has been explained by Nisbet as evidence that the slowly induced toxic reactions must not be confused with immediate allergic responses. There seems, however, to be no ready answer to Butler's assertion that in some cases recovery had followed treatment despite the continued administration of "Atebrin" and that recovery does not always follow withdrawal of the drug within a reasonable period.

There are many unexplained features about this group of skin reactions, but the importance of "Atebrin" in its causation seems to have the majority support. This standpoint is the result of careful thought, even though the conditions for observation were not always ideal during war-time and the issue was clouded by other considerations. A lively discussion followed the paper by Alden and Frank and some well-informed opinions were put forward. Most of the anomalies, however, are clarified if we accept Alden's opinion, given at the close of the discussion, that "Atebrin" is a major factor in causation, but not the only factor. Other factors were war-time difficulties, sweat and heat. He did not think that those combinations would repeat themselves—at least, he hoped not. Irrespective of other differences of opinion, we can certainly all agree with his concluding phrase.

¹ The Journal of the American Medical Association, May 31, 1947.

² Archives of Dermatology and Syphilology, July, 1947.

³ Archives of Dermatology and Syphilology, April, 1947.

⁴ Archives of Dermatology and Syphilology, January, 1947.

Abstracts from Medical Literature.

PÆDIATRICS.

Auricular Flutter with Block.

B. HOYER AND R. A. LYONS (*American Journal of Diseases of Children*, December, 1946) have reported a case of auricular flutter with auriculo-ventricular block occurring in an infant shortly after birth and persisting until he was approximately four months of age. At that time a normal sinus rhythm was resumed spontaneously, and the infant had remained well for the period of six months during which he was observed. The only possible predisposing factor was an unusual injury to the tissues of the neck. Ten previous reports of auricular flutter and block in children are reviewed.

Hypertrophic Pyloric Stenosis.

BEING interested to know the state of the pylorus at birth in infants who developed hypertrophic pyloric stenosis a few weeks later, Arvid Wallgren (*American Journal of Diseases of Children*, October, 1946) examined by X rays the stomachs of 1000 newborn boys. The appearance in all of them was quite normal. Three weeks later five of them began to vomit and soon showed the clinical and radiological signs of hypertrophic pyloric stenosis. The changes noted in the X-ray examination were that the contrast medium did not start to pass into the duodenum for one-half to two hours, the pyloric canal was narrowed so that its lumen for two to three centimetres was only a few millimetres wide, evacuation time from the stomach was delayed and the stomach was distended and showed peristaltic waves. As far as can be judged by radiological examination, therefore, the gross hypertrophy of the pylorus seen in this disease develops between birth and onset of symptoms and is not congenital.

Purpura Necrotica.

J. H. SHELDON (*Archives of Disease in Childhood*, March, 1947) describes three examples of a disease that he calls *purpura necrotica*. At its onset the illness resembled allergic purpura; the children were ill, complained of pains in the limbs, were pale and fretful and exhibited a purpuric rash which in all cases was most marked on the buttocks. The purpuric areas were raised above the skin with a distinct edge bordered by a thin red margin, while in the centre of each large patch was a hemorrhagic bulla. The most striking feature about the areas was their shape, which was distinctly geometric with straight edges, a shape that could not arise from any internal pathological process, but must have been determined by some external factor which in the author's opinion was pressure. There were no visceral manifestations, no fever, no involvement of mucous membranes and no significant changes in the blood picture. After a few days the purpuric areas hardened, became necrotic and gradually sloughed away. The smaller ones involved superficial skin only, but the larger ones penetrated deep into the muscles of buttock or leg and left severe and permanent scarring. Apart

from this recovery was complete. In seeking an explanation the author reviews Schwartzman's phenomenon in which a hemorrhagic necrosis is produced by two injections of a bacterial filtrate from a suitable organism, the first given intradermally and the second intravenously some twenty-four hours later. A few hours after the second injection extensive hemorrhagic necrosis develops at the site of the first. The author suggests that in the case of his patients some such sensitization produced a critical phase during which pressure was the adequate stimulus to provoke the hemorrhage and necrosis that he describes.

Oral Administration of Penicillin in Pædiatrics.

HENRY REISMAN AND ARTHUR GOLDFARB (*American Journal of Diseases of Children*, July, 1947) investigated the value of penicillin given by mouth to a group of children with coccil infections. They found that despite the administration of large doses neither the penicillin blood levels nor the clinical responses were encouraging. No good results were seen. Some fair results were obtained, but they were certainly not as good as would have been expected with sulphadiazine given orally. The penicillin used was in a tablet buffered with aluminium hydroxide, calcium carbonate and magnesium oxide. Most patients were given 50,000 or 100,000 units every hour during the day and every two hours during the night. The authors conclude that the use of buffers has not solved the problem of the oral administration of penicillin. They then investigated certain factors influencing the absorption of penicillin from the alimentary tract, and found that it was absorbed best if given when the stomach was empty, and that alkaline buffers were of no use, absorption being quicker and blood levels higher if a simple solution of the drug was used. There was great variation between different patients and the results were unreliable.

Cerebral Damage in Infants and Children.

In his presidential address to the American Pediatric Society, Harold K. Faber (*American Journal of Diseases of Children*, July, 1947) makes some observations on the causes and possibilities of prevention of cerebral damage in infants and children. He feels that pediatricians have been thinking too long in terms of intracranial hemorrhage and too little in terms of anoxemia. He discusses 99 children, all with cerebral atrophy which has been demonstrated by air encephalography, and which is in all cases presumably of extrinsic rather than genetic origin. He records the prenatal, perinatal and postnatal events that could have contributed to the damage. Prenatal episodes seemed important in 35% of cases, and those occurring most often were placental separation (bleeding) including placenta previa, toxemia of pregnancy and oversize of the infant. Premature rupture of the membranes, maternal trauma, Rh incompatibility, premature labour pains, attempted abortion, cardiac decompensation and maternal infectious disease occurred less often. Of the perinatal factors, nitrous oxide anaesthesia (which far too often results in anoxemia from an

effort to make the anaesthetic effective), heavy sedation, breech presentation, abnormal deliveries and the cord tight round the neck seem most important. At birth 61 of the babies appeared normal, 22 had prolonged apnoea or cyanosis and 12 were premature. Of the postnatal factors infection, particularly encephalitis, played the biggest part. The author's aim is to prevent the tragedy of mental deficiency, and he asks for critical consideration of these factors, some of which can be prevented or diminished if their danger is realized.

Early Immunization against Pertussis.

REALIZING that the immune responses to pertussis immunization in babies less than seven months of age are unreliable, but that three-fourths of the deaths from pertussis are among children of this age group, J. M. Adams *et alii* (*American Journal of Diseases of Children*, July, 1947) endeavoured to find a satisfactory way of protecting young babies. They used a super-concentrated phase 1 pertussis vaccine containing forty thousand million organisms per millilitre, and gave a total dose of 2.5 millilitres divided into three doses. Twenty-one babies received weekly injections during the first month of life, and 15 of them showed a significant rise in titre of pertussis antibodies, most of them within a week of the third injection. The level, however, fell rapidly during the next few weeks. The authors intend to see if it can be maintained by repeated injections during the first year. The next group of babies received the same doses of vaccine, but at monthly intervals during the first three months of life; none of them showed any rise in antibody level. A group of mothers were given the same dose of vaccine during the last three months of pregnancy. The mean titre of antibody in the mothers' blood was one in 320, and the mean titre in the cord blood was one in 180. This level gradually fell in the babies' blood during the first six months of life.

ORTHOPÆDIC SURGERY.

The Evaluation of Cortical and Cancellous Bone as Grafting Material.

LEROY C. ABBOTT *et alii* (*The Journal of Bone and Joint Surgery*, April, 1947) consider that it should be emphasized that the mature elements of either a cortical or a cancellous bone graft seldom survive transplantation. They state that those elements which may survive and produce new bone are the cells of the so-called endosteal and periosteal layers. A cortical graft is a solid mass of mature elements with its surfaces only covered by endosteum and periosteum. Therefore it possesses strength, but has little osteogenic power. On the other hand, cancellous bone is of a loose pattern with interlacing and branching trabeculae, every one of which is covered by endosteal cells. The authors consider that it possesses a high osteogenic power. Furthermore, this very loose structure permits of early and thorough revascularization, and the cortical bone as a grafting material is most useful where strength is of primary importance, as in the united fractures of

the shafts of the long bones. It may be used to advantage with cancellous bone which furnishes the osteogenetic medium. Cancellous bone as a grafting substance is preferable in the treatment of ununited fractures of the ends of the long bones and defects of bone caused by tumours or infection, for fusion of joints, for fusion of the spine, and in correction of severe deformity by the open-wedge type of osteotomy. In the case of compound fractures with infection, early and complete healing of the wound by excision of scar, removal of sequestra, plastic procedures on the skin and soft parts, and the use of the sulphonamides and penicillin is of the utmost importance. Compound infected fractures, with loss of substance, remain a difficult problem, although notable advances have been made in their treatment during the recent war. The authors consider that, if there is moderate loss of substance, success has attended the use of dual or triple grafts of cortical bone, with cancellous bone alone, or with the two types used jointly. It is true, however, that, in many cases of extensive defects, healing across the gap may be incomplete, or fracture may occur through immature callus. In such cases several bone grafting operations may be needed. In some instances it is best to perform the operation in two stages. The authors state that in the first stage the gap is filled with cancellous bone to secure early union of the fragments and to provide a continually vascular bed to which the cortical grafts are applied at the time of the second operation. Uniform revascularization of the cortical grafts may then be secured with complete consolidation of the fracture. The authors believe that in cases of non-union or cavity formation with infection where healing of the wound cannot be obtained, particularly in the ends of the long bones and the bones of the carpus and tarsus, it is worth while to use cancellous bone as a grafting material. In such cases union of the fragments or obliteration of the cavity may be secured. The authors emphasize that they found cancellous bone to possess a high degree of viability in the presence of infection, particularly if penicillin was employed before and after the operation. On the other hand, a cortical graft seldom survives infection, and generally is extruded from the wound as a sequestrum.

Low Back Pain in Relation to the Disk Factor.

ARTHUR STEINDLER (*The Journal of Bone and Joint Surgery*, April, 1947) states that three pathological facts are believed to be of significance in the analysis and differentiation of low back pain in relation to the intervertebral disk factor. Firstly, the disk has few, if any, sensory fibres, while the neighbouring capsular ligamentous structures are richly endowed with sensory elements, and all the sensory endowment comes to these fibres from branches of the posterior primary division. Secondly, during the process of degeneration of the disk, and as a result of it, the equilibrium between the disk and the longitudinal ligamentous system is destroyed and this disturbance is only incompletely compensated for by arthritic ledges and buttresses. The result is that the junction between the vertebral bodies

is loosened; and stress is placed, therefore, upon the supporting ligamentous and muscular system. Thirdly, in the presence of this disturbed equilibrium, the disintegration of the disk proceeds, leading finally to herniation into the spinal canal. Herniation is an evolutionary process, which shows phases in which the protrusion is still free and movable and capable of spontaneous reduction; in other phases there are fixation of the protrusion and definite adhesions to nerve trunks. The author considers that these pathological observations have certain diagnostic implications. First of all, one must prove that a disk lesion exists and, if it does, that it is responsible for the radiation; and next, that it produces other objective, so-called neurological signs. The "Novocain" test eliminates the diagnosis of a protruded disk in those cases in which the sciatic radiation is purely a reflex phenomenon. These patients show no neurological signs, that is, no areflexia, no paresis, no anesthesia, and no anesthesia. The test is applicable only if a trigger point exists, because the substance of the test is that the trigger pain and the sciatic pain should completely and simultaneously disappear upon the injection of 1% procaine solution. The test is based upon the fact that the local lesion on the one hand and the sciatic area on the other hand are anatomically entirely and completely independent of each other as far as nerve supply is concerned, since the former is supplied entirely by the posterior primary division and the latter by the anterior primary division. On the basis of the pathological findings, it is concluded that the best policy would be to initiate a conservative trial treatment in all doubtful cases. On the other hand, where the diagnosis is certain on the grounds of the clinical examination or where the test and trial treatments have failed, the operation is indicated. The author states that he prefers, firstly, to be conservative in the laminectomy, that is, to remove as little of the arches as possible; secondly, the laminectomy should be followed by fusion of the spine by one of the recognized methods, even though it entails a longer period of recumbency.

End Result Study of the Intervertebral Disk.

RAYMOND E. LENHARD (*The Journal of Bone and Joint Surgery*, April, 1947) has reviewed results obtained among patients with a herniated intervertebral disk operated on by Dandy in the years 1941 to 1944 inclusive. Dandy operated on 843 patients, of whom 67% were males and 33% females. Of these patients 147 were examined. The author states, however, that few of the patients, only 23.8%, were entirely relieved of all symptoms and able to perform their normal activities without complaint. Good results were obtained in 67.5%, 17% of patients were classified as "improved" and 15.5% as "not improved". Three hundred and thirty-six patients were not examined, but replied to a questionnaire sent in March, 1945, to all patients who had been operated upon. Of this group 59.5% were considered to have a good result, 22.9% were improved and 17.7% were not improved. An analysis of the figures showed that the results were not dependent on the type of operative removal of the disk. Before January, 1942, the loose fragment or sequestrum

alone was removed; between January, 1942, and June, 1943, a curettage or removal of the entire disk was carried out; and after June, 1943, multiple disks were recognized and removed entirely. Recurrences of symptoms and, therefore, supposed recurrences of disk lesions occurred in some of the patients. Of the 147 patients examined, twenty had had multiple operations. The author states that there was no distinct relationship between a narrowed intervertebral space seen on X-ray examination and the faulty disk. Either it was at the level of the narrowed space or it was at the space above or below it. Of the patients reexamined, 5% had arthritis of the lumbar part of the spine or the sacro-iliac region or of both. Post-operative X-ray examination revealed no appreciable change in the interspace involved. Fusion of the posterior part of the spine was not performed on any of the patients examined.

Ruptured Intervertebral Disk and Sciatic Pain.

JOSEPH S. BARR (*The Journal of Bone and Joint Surgery*, April, 1947) states that it is important to realize that a patient with back pain, but no leg pain, may be suffering from a ruptured intervertebral disk; in some of these patients, symptoms and signs of sciatic pain will eventually develop. If the disk rupture is small or is placed far laterally, it may produce only local backache. Such a lesion will escape visualization by contrast myelography and it will in most instances escape visualization at the time of laminectomy. The author considers that ruptured intervertebral disk is the most common cause of intractable low back pain and sciatic pain, but it is not the only cause. Acute ligamentous and muscle strains do occur. Backache due to postural defect is common. Ankylosing arthritis can produce signs and symptoms almost indistinguishable clinically from a disk lesion. The author believes that when myelography fails to show a filling defect, the lesion, if present, will be found at the lumbosacral level in almost every case. Operative treatment should, as a rule, be reserved for those patients who have intractable pain in spite of adequate, conservative treatment, and for those who show evidence of moderate to severe nerve root compression. A third group for whom operative treatment seems to be indicated are those who have recurring episodes of low back and sciatic pain of such frequency and intensity as greatly to reduce the patient's normal capacity for physical activity. The results of a recent questionnaire received from 234 subjects seem to indicate a modest but definite superiority of the results in cases in which fusion was carried out over those in which it was not. End results were available in the case of twenty-four compensation patients. Of these patients 50% had absolutely no complaints, and 71% were back at full work. The author believes that it should be frankly recognized that most of these industrial accident patients are labourers who in the course of their ordinary work subject the back to extensive strain. They cannot be expected to return to work after a disk operation in less than six months; and among the older men who have arthritis or other complicating factors a certain proportion will never return to full work.

British Medical Association News.

SCIENTIFIC.

A MEETING of the Paediatric Section of the New South Wales Branch of the British Medical Association was held on July 11, 1947, at the Royal Alexandra Hospital for Children, Camperdown.

Superficial Haemangiomas.

Dr. J. STEIGRAD discussed the treatment of superficial haemangiomas in children. He said that he was presenting that subject, not because his inadequate experience qualified him to speak on it, but rather because he wished to stimulate discussion and perhaps to prompt closer cooperation between the dermatologist, the radiotherapist and the surgeon, so that adequate treatment would be assured in each case. At the Royal Alexandra Hospital for Children patients were referred between departments; but even so, closer liaison might be possible in order that all means of therapy might be adequately used.

Dr. Steigrad then said that an haemangioma might be defined as a true neoplastic process involving vascular tissue; but he was concerned only with those producing superficial lesions on the skin or mucous membranes. It was thought that haemangiomas were congenital in origin. Watson and McCarthy had reported a series of 1001 patients presenting 1308 lesions, and had stated that 73% of the lesions were truly congenital in origin, while 85% had developed before the end of the first year of life. Watson and McCarthy had also considered, however, that many of the lesions were present at birth, but were unnoticed because of the small size.

Discussing classification, Dr. Steigrad said that for his purpose six types of haemangiomas might be described: (i) capillary haemangioma; (ii) cavernous haemangioma; (iii) hypertrophic haemangioma or haemangio-endothelioma; (iv) racemose or circoid haemangioma; (v) diffuse systemic haemangioma; (vi) *nevus vinosus* or port-wine stain. Forms of treatment available included (a) carbon dioxide snow, (b) diathermy or cautery therapy, (c) sclerosing therapy by means of injections, (d) radiation therapy, (e) surgical excision. Not infrequently, the therapy applied in each individual case depended on whether the patient was examined by a dermatologist first or by a surgeon, and also on the facilities that were available. Carbon dioxide snow was satisfactory for small capillary haemangiomas, at times for the small hypertrophic type, and for clearing away mottling after injection therapy. Solid carbon dioxide snow was fashioned by a knife into suitable shapes and pressed tightly to the lesion for five to ten seconds. Diathermy and cautery treatment appeared of value only for the small stellate or spider-web variety. As a sclerosing agent for injection, sodium morrhuate (5% solution) was used. It appeared effective and had the added advantage over quinine and urethane and other sclerosing agents that it did not cause painful necrosis when injected accidentally into normal tissues. The technique was simple; 0.25 to 3.0 millilitres of the solution were injected, according to the size of the nevus, by means of a hypodermic needle. Compression might be applied for a few minutes and the injection repeated at intervals of several weeks. Radiation therapy was used widely in other countries. It appeared that the lesions were radio-sensitive, particularly in early life, and so treatment should not be delayed. Dr. Steigrad said that he was anxious to hear from others experienced in that type of therapy about the matter. Referring to surgical excision, Dr. Steigrad said that in areas where the scar was not of great moment, such as skin covered by clothes, and in areas where skin was lax and a fine linear scar was a possible result, excision was wise. Also when the lesion was of the large hypertrophic type, excision might be wise. Didactic statements were unwise, and were made only to provoke discussion. Surgical excision should be used to remove all lesions where a linear scar was not of great importance. The result was immediate, and the only disadvantage was that general anaesthesia was necessary. Sodium morrhuate injections were of value particularly in the treatment of the cavernous type of haemangioma and of some capillary haemangioma. It was of little value in the treatment of the hypertrophic type. Carbon dioxide snow should be used for the small superficial lesions. The results of radiation therapy were to some of those present a closed book; but many hospitals and clinics used it widely.

Dr. Steigrad then showed a series of patients illustrating his remarks and the results of treatment.

Dr. HENRY SHARP said that he wished to stress the importance of early treatment, preferably within the first few weeks of life, for two main reasons. (i) The cells were less differentiated and therefore more sensitive to radiation therapy at that stage. (ii) If it was left, the haemangioma might rapidly grow from a small lesion to cover large areas within a few weeks. The lesions did not undergo spontaneous healing, although it was often stated that they did. Phaller searched the literature and was unable to find any recorded instance. In certain cases, however, as a result of trauma or infection, the lesion might undergo necrosis, and this occurred usually with severe scarring.

Dr. Sharp then referred to the usual methods of treatment, the carbon dioxide snow pencil, sclerosing fluids and radiation therapy. He said that the application of the carbon dioxide snow pencil with moderate to firm pressure for six to ten seconds was probably the most convenient and satisfactory method for flat superficial lesions one to two millimetres in thickness and not exceeding the area of a two-shilling piece. Sclerosing fluids were used for deeper lesions. They had the disadvantage of requiring numerous tedious and painful injections, and might result in ulceration and serious haemorrhage. Dr. Sharp believed that they often gave rise to more scarring than was desirable, and frequently further treatment by carbon dioxide snow was required to remove the lesion completely. However, the method had its place in the treatment of lesions around the eye, in which irradiation, especially the γ rays of radium, had been known, despite careful screening, to give rise to cataract. Radiation therapy was considered the best method at present available, not only because of the final cosmetic results obtained, but also because of the ease of application and the absence of any pain occasioned to the child by the treatment. X radiation was preferred to radium, as the dose, usually between 600r and 1200r, could be given more rapidly and with greater accuracy to irregular lesions and surfaces. Furthermore, the depth of the dose could be varied to suit individual lesions by filtration and by variations of the kilovoltage. Radium, although favoured by some authorities, required a specially trained staff to handle it, and, except in certain isolated cases, possessed no advantages over X radiation. Good results with irradiation might not be obtained if the lesion had been scarred with previous carbon dioxide snow or sclerosing fluid treatment. Lesions in the neighbourhood of epiphyses or on the scalp should be treated by the divided dose method, to avoid damage to the growing bone or hair, although in the case of the latter, the lesion itself frequently gave rise to permanent alopecia. In conclusion, Dr. Sharp said that he agreed most strongly with Dr. Steigrad that surgery had little place in the treatment of cavernous haemangioma.

Dr. ERIC FRECKER said that he had reviewed the results of some 50 consecutive cases of angioma treated during the past few years. Most of the lesions were of the cutaneous "strawberry" type, varying in size from one to six or seven centimetres in diameter. Treatment had been exclusively by X rays. Superficial lesions were treated by contact therapy with monthly doses of 500r to 800r; usually two or three doses were necessary. The results had been uniformly good, though in many instances slight discoloration of the skin remained. Lesions around the eye and on the lids were treated under local anaesthesia with a lead cup beneath the lids. The eye was thus completely protected from the effects of irradiation. Slight general anaesthesia was often necessary to immobilize young children, though infants could usually be held firmly without it. Subcutaneous cavernous angiomas were treated by ordinary deep X-ray therapy with light copper filtration in repeated doses of about 800r, again at intervals of two to four weeks. Results were satisfactory, and no skin damage occurred. Of major lesions, one extensive lesion involving almost the whole of the thigh was treated without result; but another large lesion, extending from the floor of the orbit back to the tonsil, cheek and soft palate, had completely resolved and had remained healed for some seven years up to the time of the meeting. Capillary angiomas were not treated, as they failed to respond. Radium was not used on any of these patients, though angiomas responded well to this agent. Radium in the neighbourhood of the eye in the young was dangerous, as the lens could not be adequately protected.

Dr. Frecker then stressed three points. (i) Patients should be treated as young as possible, even at the age of a few weeks. The lesions were very radiosensitive at first, but the radiosensitivity declined rapidly in the first few years. (ii) Treatment should be periodic and gradual, with long intervals to allow resolution before the dose was repeated. (iii) Care had to be taken to avoid injuring underlying sensitive structures, particularly epiphyses, genital glands and the lens of the eye. Contact therapy was

particularly suitable for such superficial lesions, owing to its small penetration. Dr. Frecker expressed the opinion, with some diffidence in the absence of any personal experience with other methods of treatment, that all angiomata if possible should be primarily treated by irradiation. Other methods could be used if judicious irradiation failed. In some deep lesions surrounding sensitive structures, radiation treatment entailed definite risks, as the deep structures could not be adequately protected. In such instances, surgery and inject. on were preferable if applicable.

Dr. T. Y. NELSON said that he had little to add to what had been said about the clinical aspects of the problem. Small superficial naevi gave little trouble, and could be treated by carbon dioxide snow or excision. He had used injections of sclerosing solutions extensively for the cavernous type of lesions, and thought that they were satisfactory for small lesions, but that the larger lesions should be submitted to irradiation from the first. Even after successful radiotherapy there was usually a mass of fibrous tissue which needed excision; but the operation was much smaller than a primary excision would have been. He felt that the real problem concerned lesions of the face. Dr. Nelson said that he was interested in one of the patients shown who had a lesion of the hypertrophic type on the scalp. In a similar case in which he had excised the lesion some years previously there had been a recurrence of the tumour; this showed the essential neoplastic character of the lesions and the need for wide excision. He was glad to note the stress that had been laid on the fact that superficial naevi did not disappear. The surgeons had encountered several cases in which considerable increase in size had occurred in a few months, emphasizing the need for early treatment. With regard to radium, Dr. Nelson said that he had had no personal experience, but had been taught that there were dangers in its use on the nose and near the eyes, since, unless the dosage was accurate, there was a risk of necrosis of deeper structures. The last patient shown provided an interesting example of the association of cutaneous lesions with extensive involvement of deeper structures. It had long been recognized that there was an association between cutaneous and intracranial vascular anomalies, especially in the distribution of the fifth cranial nerve—an association to which French writers had given the term "neurocutaneous syndrome", and in which the defect in development occurred at a different stage of embryogenesis from neurofibromatosis and tuberose sclerosis. There had recently been in the hospital an example of extensive naevoid formation covering practically one-half of the entire body and associated with hydrocephalus. In conclusion, Dr. Nelson said that he thought that the discussion had been of the greatest value, and if it resulted in giving radiation treatment a wider application, it would be of great benefit.

NOTICE.

THE General Secretary of the Federal Council of the British Medical Association in Australia has announced that the following medical practitioner has been released from full-time duty with His Majesty's Forces and has resumed civil practice as from the date mentioned:

Dr. Herbert Hughes, 195, Crown Street, Wollongong (September, 1947).

Naval, Military and Air Force.

APPOINTMENTS.

THE undermentioned appointments, changes *et cetera* have been promulgated in the *Commonwealth of Australia Gazette*, Number 198, of October 16, 1947.

AUSTRALIAN MILITARY FORCES.

Australian Army Medical Corps.

NX183 Lieutenant-Colonel (Temporary Colonel) C. R. Blomfield relinquishes the appointment of Deputy Director-General of Medical Services, Increment Medical "A" Branch, Army Headquarters, and is placed upon the Regimental Supernumerary List, 22nd May, 1947.

VX503636 Captain (Temporary Lieutenant-Colonel) G. R. A. Syme is placed upon the Regimental Supernumerary List, 10th May, 1947.

NX36 Lieutenant-Colonel (Temporary Colonel) G. F. Hill relinquishes the rank of Temporary Colonel, is transferred to the Reserve of Officers (Australian Army Medical Corps) with the rank of Lieutenant-Colonel, and is granted the honorary rank of Colonel, 24th May, 1947.

Major A. P. Davis is appointed from the Reserve of Officers (Australian Army Medical Corps) with the rank of Major (part-time duty), 5th June, 1946.

The name of Lieutenant-Colonel A. Fryberg, M.B.E., is as now shown and not as it appeared in Executive Minute No. 27 of 1947, promulgated in *Commonwealth Gazette*, No. 55, of 1947.

No. 110 (Perth) Military Hospital.—The name of WX36171 Captain H. S. Berlinshan is as now shown and not as it appeared in Executive Minute No. 52 of 1947, promulgated in *Commonwealth Gazette*, No. 81, of 1947.

Inter-Service Medical Wing Demobilization Centres (Australian Military Forces Component).—The army number of SX33608 Captain C. T. James is as now shown and not as it appeared in Executive Minute No. 55 of 1947, promulgated in *Commonwealth Gazette*, No. 85, of 1947.

Reserve Citizen Military Forces.

Australian Army Medical Corps.

3rd Military District.—To be Lieutenant-Colonels and are granted the honorary rank of Colonels: Max Alfred Rees, 20th May, 1947, and James Ellis Gillespie, 23rd April, 1947.

4th Military District.—The undermentioned officers are retired: Captains L. G. Muirhead, 19th April, 1947, and E. B. Thomas, 3rd June, 1947, and Honorary Captain H. W. D. Stoddard, 30th July, 1947.

ROYAL AUSTRALIAN AIR FORCE.

Citizen Air Force: Medical Branch.

Lynn David Walters (277535) is appointed to a commission with the temporary rank of Squadron Leader, 1st September, 1947, for duty as a physician specialist, part time.

Reserve: Medical Branch.

The appointment of Flight Lieutenant L. D. Walters (277535) is terminated, 31st August, 1947.—(Ex. Min. 67—Approved 15th October, 1947.)

Correspondence.

THE ARCHIBALD WATSON MEMORIAL LECTURE.

SIR: Sir Henry Newland's Archibald Watson Memorial Lecture (THE MEDICAL JOURNAL OF AUSTRALIA, September 27, 1947) is a notable example of historical medical writing which has its finest and most constructive fulfilment in the "memorial lecture"; the purpose of which (as I apprehend it), as well as due and seemly tribute, is to inspire and inform by study of a great mind and a great man; and by appropriate application to link the lessons of the past with the problems of the present. Watson's greatness, as it has seemed to me (I had some slight opportunity of seeing him in action), lay in his intense appreciation of the importance of exact knowledge; and of the need for constant search—whether by clinical observation or by analytical research—for the basic cause in clinical phenomena, and for the elemental factors which determine success in treatment. And this attitude, I suggest, is as important today (and, I submit, with the deference proper from age to youth, as necessary) as in Watson's time. As important, for example, as when by an observation which any student might have made, Lawson Tait in 1883 showed that "the tragedy" [of the woman with a ruptured ectopic gestation] "slowly and almost inevitably dying of hemorrhage" might be averted by a very simple abdominal operation; and Lister that the abdomen was no longer a preserve closed to all save experts; and thus together put it within the power of an ordinary "bush doctor" to achieve the miracle of saving a life.

The human and the professional interest of this dramatic episode in the history of medicine, so finely described by Sir Henry, tempts me to record a personal experience which seems not inappropriate as a footnote to Sir Henry's study. It concerns one of the earliest episodes of my professional life, which began (as should that of all, or most, practitioners) in "the bush". In January of 1901, in a small roadside "pub" 70 miles from Brisbane, and 30 from the nearest railway, I was called to see a young woman who

had been brought in a "spring-cart" 30 miles down the range from some old diggings. She was considerably, but, considering the circumstances, not excessively shocked. I diagnosed—no slight venture in those early days—a ruptured ectopic. What should I do? The alternatives were the trip to Brisbane—30 miles of it in the spring-cart over rough bush roads—or operation on the spot. The fact that by good fortune I had two first-class nurses nursing a terrific case of typhoid—we had them in plenty in those days!—made me decide to operate. A big drought was on, and the water available was from a very muddy waterhole. We strained it through cotton wool and boiled it "like hell". One nurse gave ether, the other helped me. Happily the diagnosis was correct, and the *fons et origo mali* proved readily accessible when the clots were cleared out. A simple silk ligature did the trick. We closed the abdomen, and the patient "made an uninterrupted recovery". A worthwhile life was probably saved, a priceless memory gained—and a step made in the *iter ad astra* of a hard-working young doctor!

Moral. Let us not, in the pride of today's triumphs, fail to honour the "pioneers". Sir Henry shows us how this should be done.

Yours, etc.,

A. G. BUTLER.

Canberra,
October 14, 1947.

OBSERVATIONS ON THE EPIDEMIOLOGY OF TSUTSUGAMUSHI DISEASE IN NORTH QUEENSLAND.

SIR: I should like to congratulate Dr. Southcott on his excellent "Observations on the Epidemiology of Tsutsugamushi Disease in North Queensland" (THE MEDICAL JOURNAL OF AUSTRALIA, October 11, 1947).

However, I must challenge his introductory statement that: "At the present time it is generally accepted that for a diagnosis of tsutsugamushi to be made either of two serological criteria should be fulfilled, these being (i) that the titre against *Bacillus proteus* OXK should be 1 in 160, or (ii) that if the titre is lower than 1 in 160 it should rise during the course of the disease."

In the paper to which Dr. Southcott refers I wrote that it is necessary to do animal inoculations as well as serological examinations to establish a definite diagnosis in many cases. This conclusion was reached because: (i) Of the nine cases of my series in which neither of the above criteria was fulfilled, there was real doubt about the accuracy of the clinical diagnosis in only one. Of the remaining eight cases six were proved to be rickettsial infections by the inoculation of white mice, and in the other two cases the samples of serum were collected late in the course of the illness and showed a fall of titre which is just as significant as an early rise. (ii) Of the five other cases which I listed as doubtful, two did show a rise of titre from nil to 1 in 20 and another two had a repeated but unvarying titre of 1 in 160 over periods when variation would be expected. Inoculation of mice was not done in four of my six doubtful cases. (iii) One patient whose illness was shown to be due to rickettsial infection by inoculation of white mice, and whose serum was tested at intervals over a period of twenty-eight days, gave completely negative agglutination results.

Yours, etc.,

W. G. HEASLIP.

27, Park Road,
Kensington Park,
South Australia.
October 18, 1947.

The Royal Australasian College of Surgeons.

THE RUPERT DOWNES MEMORIAL FUND.

THE Royal Australasian College of Surgeons has forwarded the following information about the Rupert Downes Memorial Fund.

In response to the appeal for money to establish a memorial to the late Major-General Rupert Major Downes, the sum of six hundred and thirty pounds (£630) has been subscribed. The organizers of the appeal are most grateful to donors for the contribution made.

After careful consideration, it has been decided to hand the capital sum to the Council of the Royal Australasian

College of Surgeons with a request that it should invest it and hold it as an endowment for a triennial lecture to be entitled "The Rupert Downes Memorial Lecture". The place and time of this triennial lecture will be determined by the Council of the College and it is hoped that it will be possible to arrange that it shall be delivered in the various States in turn.

The lecture shall be open to all members of the medical profession and such other guests as the Council of the College may invite. Its subject will be related to some aspect or aspects of military surgery, medical equipment (military and civil), the surgery of children, neurosurgery, general surgery, medical ethics or medical history, these being subjects in which Major-General Downes was particularly interested.

Mrs. Downes is pleased with the above suggestions, and has expressed a wish that the following personal message should be sent from her to all her husband's friends and fellow officers who have subscribed to the fund:

I want to thank, most sincerely, all Rupert's friends for their generosity which has made possible a memorial to him in the form of the Rupert Downes Memorial Lecture. It has given my daughters and me very great happiness to know that Rupert's work and his simple, upright and lovable character were held in high esteem by his fellow men.

Committee in New South Wales.—Sir Charles Blackburn, the Honourable Arthur E. Colvin, Arthur L. Dawson, Wilfred Evans, Alex. McIntosh, William Wood.

Committee in Queensland.—G. W. C. Macartney, K. B. Fraser.

Committee in Victoria.—Sir Alan Newton, Victor Hurley, W. G. D. Upjohn, W. W. S. Johnston.

Medical Practice.

STREPTOMYCIN IN PULMONARY TUBERCULOSIS.

THE following statement on streptomycin in pulmonary tuberculosis is published at the request of the Acting Chairman of the National Health and Medical Research Council.

Streptomycin inhibits the growth of *Mycobacterium tuberculosis* *in vivo* clinically and experimentally. From clinical observations it appears that its action is bacteriostatic rather than bactericidal, and it may be accepted that it exerts a suppressive action upon the course of most forms of tuberculosis in human beings.

The development of bacterial resistance to this antibiotic is a very frequent occurrence, manifesting itself usually between the twenty-eighth and fifty-sixth days of treatment. Thus the greatest field of usefulness of streptomycin should be found in those forms of the disease which might be permanently benefited by therapy of one or two months' duration. It is equally apparent that the course of chronic fibrotic forms of the disease is unlikely to be affected in any permanent manner within this period of time, although temporary regression may occur.

At present it is considered that streptomycin is of value in the treatment of the following forms of tuberculosis:

1. Generalized hematogenous tuberculosis and tuberculous meningitis. These are acute manifestations of the disease and the immediate effect of treatment is often dramatic. The final results of therapy are far from satisfactory.

2. Non-surgical pulmonary tuberculosis. The caseo-pneumonic and the predominantly exudative forms respond favourably. A rapidly progressive lesion may become sufficiently controlled to permit of other measures such as collapse therapy being undertaken. It is of particular value in controlling an acute spreading lesion following haemoptyses.

3. Ulcerative lesions of the larynx, trachea and bronchus. Considerable improvement may occur, and if the parenchymal lesion can be controlled recurrence is unusual.

4. Surgical pulmonary tuberculosis. The use of streptomycin pre-operatively and post-operatively is believed to lessen the risks of post-operative tuberculous complications and to hasten the recovery of patients. It is well to remember that the longer the pre-operative period of administration is continued the less time is available post-operatively before bacterial resistance is likely to occur.

5. Tuberculosis of the genito-urinary tract. In renal tuberculosis amelioration of symptoms may occur, but

streptomycin is not curative. Cystitis is improved considerably and in early cases cure may be effected. Fistulae associated with tuberculous epididymitis have been reported as cured.

6. Tuberculosis of bone and joints. Alleviation of symptoms and temporary regression of the lesion may be expected.

Methods of Administration and Dosage.

The dosage is from one to three grammes within twenty-four hours, given in divided doses intramuscularly every four hours. In the majority of patients two grammes will be found adequate, and on this dosage it is thought that toxic manifestations are less frequent.

Solutions containing 25 to 100 milligrammes per millilitre may be used for topical application, intrabronchially or in aerosol sprays. In ulcerative lesions of the respiratory tract topical application or aerosol spray should be used in addition to parenteral administration. It is recommended that two millilitres be used every hour for eight to ten hours daily if possible.

In tuberculous meningitis 100 to 200 milligrammes in two to five millilitres of isotonic saline solution should be given every twenty-four to forty-eight hours for two to six weeks in addition to parenteral administration.

Limitations and Dangers of Streptomycin in Tuberculosis.

Usually tuberculosis produces destructive lesions within the organs it attacks. Healing is accompanied by much fibrosis. Streptomycin cannot restore tissue already destroyed.

In the majority of cases therapeutic action ceases within two months due to bacterial resistance, and therefore other methods of treatment must not be neglected. In almost every patient to whom it is given for a period of more than three weeks some toxic manifestations are certain to occur. Therefore this antibiotic should be withheld from those patients who are making satisfactory progress under conventional therapy. It should not be regarded as a substitute for other accepted forms of treatment.

Australian Medical Board Proceedings.

NEW SOUTH WALES.

THE undermentioned have been registered, pursuant to the provisions of the *Medical Practitioners Act, 1933-1939*, of New South Wales, as duly qualified medical practitioners:

Hearne, Edward Allen, M.B., B.S., 1947 (Univ. Sydney), Sydney Hospital, Sydney.
 Heery, Peter John, M.B., B.S., 1947 (Univ. Sydney), St. Vincent's Hospital, Darlinghurst.
 Hennessy, Edmund John, M.B., B.S., 1947 (Univ. Sydney), District Hospital, Walsend.
 Himmelhoch, Albert, M.B., B.S., 1947 (Univ. Sydney), Royal Prince Alfred Hospital, Camperdown.
 Holt, Geoffrey Charles, M.B., B.S., 1947 (Univ. Sydney), Royal North Shore Hospital, St. Leonards.
 Housego, Christopher John, M.B., B.S., 1947 (Univ. Sydney), St. Vincent's Hospital, Darlinghurst.
 Hyam, Hilary Fay, M.B., B.S., 1947 (Univ. Sydney), Royal North Shore Hospital, St. Leonards.
 Jackson, Kenneth Charles, M.B., B.S., 1947 (Univ. Sydney), St. George District Hospital, Kogarah.
 Jaconelli, Joseph, M.B., B.S., 1947 (Univ. Sydney), St. Vincent's Hospital, Darlinghurst.
 Jennaway, Ronald James, M.B., B.S., 1947 (Univ. Sydney), Royal Prince Alfred Hospital, Camperdown.
 Jones, Margaret Mary, M.B., B.S., 1947 (Univ. Sydney), District Hospital, Lithgow.
 Joseph, Douglas, M.B., B.S., 1947 (Univ. Sydney), Royal North Shore Hospital, St. Leonards.
 Joseph, Farnley Vincent, M.B., B.S., 1947 (Univ. Sydney), Mater Misericordiae Hospital, North Sydney.
 King, Raymond Henry, M.B., B.S., 1947 (Univ. Sydney), Royal Prince Alfred Hospital, Camperdown.
 Kinsella, Edward Louis, M.B., B.S., 1947 (Univ. Sydney), St. Vincent's Hospital, Darlinghurst.
 Lamond, Thomas Stansfield, M.B., B.S., 1947 (Univ. Sydney), Balmain and District Hospital, Balmain.
 Lehmann, Geoffrey Maxwell, M.B., B.S., 1947 (Univ. Sydney), General Hospital, Launceston, Tasmania.
 Lewis, Montague Bernard, M.B., B.S., 1947 (Univ. Sydney), St. George District Hospital, Kogarah.
 Lindsay, Norman Leslie, M.B., B.S., 1947 (Univ. Sydney), Sydney Hospital, Sydney.

Loughman, Edward, M.B., B.S., 1947 (Univ. Sydney), Royal Prince Alfred Hospital, Camperdown.
 McCarthy, John Hanshaw, M.B., B.S., 1947 (Univ. Sydney), Royal South Sydney Hospital, Zetland.
 McDonald, John David, M.B., B.S., 1947 (Univ. Sydney), Royal Prince Alfred Hospital, Camperdown.
 MacFadzean, Reginald Victor, M.B., B.S., 1947 (Univ. Sydney), Sydney Hospital, Sydney.

QUEENSLAND.

THE undermentioned have been registered, pursuant to the provisions of the *Medical Acts, 1939 to 1946*, of Queensland, as duly qualified medical practitioners:

Anderson, Alexander Leslie, M.B., B.S., 1944 (Univ. Melbourne), Girvan, Point Lonsdale, Victoria.
 Birchley, Ian Keith, M.B., B.S., 1947 (Univ. Queensland), 85, Dornoch Terrace, Highgate Hill, Brisbane.
 Cramond, Ernest Humphrey, M.B., B.S., 1947 (Univ. Queensland), Lade Street, Holland Park, Brisbane.
 Edwards, Richard Edward Evan, M.B., B.S., 1947 (Univ. Queensland), 287, Wickham Terrace, Brisbane.
 Erzetic, Ernest William, M.B., B.S., 1947 (Univ. Queensland), 99, Pear Street, Greenslopes, Brisbane.
 Graham, Robert Victor, M.B., B.S., 1947 (Univ. Queensland), Allison, Comona Street, Kelvin Grove, W.I., Brisbane.
 Hood, James Hugh, M.B., B.S., 1947 (Univ. Queensland), 274, Hume Street, Toowoomba.
 Huybers, Kenneth Alfred, M.B., B.S., 1947 (Univ. Queensland), Massey Street, Ascot, Brisbane.
 Kelly, Andrew John, M.B., B.S., 1947 (Univ. Queensland), 28, Fifth Avenue, Coorparoo, Brisbane.
 Knyvett, Alan Ferrers, M.B., B.S., 1947 (Univ. Queensland), York Street, Coorparoo, Brisbane.
 Lane, Daniel Gerard, M.B., B.S., 1947 (Univ. Queensland), 228, Gladstone Road, Dutton Park, Brisbane.
 Leece, Charles William, M.B., B.S., 1947 (Univ. Queensland), Bronte, Station Avenue, Northgate, Brisbane.
 Lusby, Henry Lindsay John, M.B., B.S., 1947 (Univ. Queensland), 17, Palm Avenue, Ascot, Brisbane.
 Molphy, Ruth, M.B., B.S., 1947 (Univ. Queensland), Merlow, Union Street, Clayfield, Brisbane.
 McDonnell, Francis Arthur, M.B., B.S., 1947 (Univ. Queensland), 1, Dora Street, Hendra, Brisbane.
 Orde, Barbara Cooper, M.B., B.S., 1947 (Univ. Queensland), 11, Wienholt Street, Auchenflower, Brisbane.
 O'Reilly, Keith Aubrey de Vere, M.B., B.S., 1947 (Univ. Queensland), 51, Rialto Street, Coorparoo, Brisbane.
 Tange, John Damian, M.B., B.S., 1947 (Univ. Queensland), 21, Valentine Street, Toowong, Brisbane.
 Watson, Jeffrey George, M.B., B.S., 1947 (Univ. Queensland), 236, Cavendish Road, Coorparoo, Brisbane.
 Lister, Harvey Alexander John, M.B., B.S., 1944 (Univ. Sydney), Repatriation General Hospital, Greenslopes, Brisbane.
 Splatt, Alexander James, M.B., B.S., 1947 (Univ. Melbourne), Brisbane Hospital, Brisbane.
 Finckh, Gertrude Dorothea, M.B., B.S., 1946 (Univ. Sydney), Cairns Hospital, Cairns.
 Ellis, Archie Samuel, M.B., B.S., 1937 (Univ. Melbourne), D.P.M., 1946 (London), Bellevue Terrace, Clayfield, Brisbane.

Congress Notes.

AUSTRALASIAN MEDICAL CONGRESS (BRITISH MEDICAL ASSOCIATION).

THE Executive Committee of the sixth session of the Australasian Medical Congress (British Medical Association) to be held at Perth from August 15 to 21, 1948, has forwarded the following information.

Air Transport.

Air line companies have been approached regarding the providing of air transport to and from congress, and the companies are forwarding to honorary (local) secretaries of congress in each State information regarding schedules on main, subsidiary and feeder routes throughout Australia. Members attending congress are advised to communicate with the honorary (local) secretaries in the different States for full details.

Papers for Presentation to Congress.

The Committee of Honorary Secretaries of Sections, which is arranging the scientific programme for congress, would appreciate offers of original articles for delivery at congress from members who will be attending.

Accommodation.

The Accommodation and Transport Committee advises that the bookings for congress week are already very heavy, and applications of members proposing to attend congress should be made without delay to the congress office. Hotel accommodation in Perth is limited, but every effort will be made by the committee to obtain for applicants the best accommodation available.

Nominations and Elections.

THE undermentioned have applied for election as members of the New South Wales Branch of the British Medical Association:

- Crane, Enid Nance, M.B., B.S., 1947 (Univ. Sydney), 38, Herbert Street, Rockdale.
 Degotardi, John Charles, provisional registration, 1947 (Univ. Sydney), Eucalyptus Street, Gordon.
 Sheppard, Vincent Earle Moxey, provisional registration, 1947 (Univ. Sydney), Lammerburn, New River Road, Emu Plains, New South Wales.
 Finley, Adrian Geoffrey, M.B., B.S., 1944 (Univ. Sydney), 5, Shellbank Parade, Cremorne.
 Bialoguski, Michael, provisional registration, 1947 (Univ. Sydney), 226, Sydney Road, Balgowlah.

Obituary.

JOSEPH BENEDICT McELHONE.

WE regret to announce the death of Dr. Joseph Benedict McElhone, which occurred on October 21, 1947, at Darlinghurst, New South Wales.

ALEXANDER MACCORMICK.

WE regret to announce the death of Sir Alexander MacCormick, which occurred on October 25, 1947, at Jersey, Channel Islands.

Medical Appointments.

Dr. J. H. Barnes has been appointed government medical officer at Thursday Island and a health officer, in pursuance of the provisions of *The Health Acts, 1937 to 1946*, of Queensland.

Dr. B. T. Keon-Cohen has been appointed honorary orthopaedist, Royal Melbourne Hospital, Melbourne.

Dr. I. O. Thorburn has been appointed an examiner, in pursuance of the provisions of *The Nurses Registration Act, 1921-1946*, of Western Australia.

Books Received.

"Materia Medica for Nurses", by A. Muir Crawford, M.D., F.R.F.P.S.G.; Sixth Edition; 1947. London: H. K. Lewis and Company, Limited. 7½" x 5", pp. 166. Price: 5s. 6d.

"Recent Advances in Medicine: Clinical Laboratory Therapeutic", by G. E. Beaumont, M.A., D.M. (Oxon.), F.R.C.P., D.P.H. (London), and E. C. Dodds, M.V.O., D.Sc., Ph.D., M.D., F.R.C.P., F.R.I.C., F.R.S. (Edinburgh), F.R.S.; Twelfth Edition; 1947. London: J. and A. Churchill, Limited. 8" x 5½", pp. 434, with illustrations. Price: 21s.

"Rheumatism and Soft Tissue Injuries", by James Cyriax, M.D., B.Ch. (Cantab.); 1947. London: Hamish Hamilton Medical Books. 9½" x 6", pp. 410, with many illustrations. Price: 42s.

"A Textbook of Medicine", edited by Russell L. Cecil, A.B., M.D., Sc.D., with the assistance of Walsh McDermott, M.D., associate editor for Diseases of the Nervous System, Harold G. Wolff, M.D.; Seventh Edition; 1947. Philadelphia and London:

W. B. Saunders Company Limited; Melbourne: W. Ramsay (Surgical) Proprietary, Limited. 10" x 7", pp. 1764, with many illustrations, some of them coloured. Price: 70s.

"Diseases of the Chest with Emphasis on X-Ray Diagnosis", by Eli H. Rubin, M.D., F.A.C.P., F.C.C.P.; "The Principles of Surgical Treatment", by Morris Rubin, B.A., M.D.; 1947. Philadelphia and London: W. B. Saunders Company Limited; Melbourne: W. Ramsay (Surgical) Proprietary, Limited. 10" x 7", pp. 700, with many illustrations, some of them coloured. Price: 84s.

Diary for the Month.

- Nov. 4.—New South Wales Branch, B.M.A.: Organization and Science Committee.
 Nov. 5.—Western Australian Branch, B.M.A.: Council Meeting.
 Nov. 5.—Victorian Branch, B.M.A.: Branch Meeting.
 Nov. 6.—South Australian Branch, B.M.A.: Council Meeting.
 Nov. 7.—Queensland Branch, B.M.A.: Branch Meeting.
 Nov. 11.—Tasmanian Branch, B.M.A.: Ordinary Meeting.
 Nov. 11.—New South Wales Branch, B.M.A.: Executive and Finance Committee.

Medical Appointments: Important Notice.

MEDICAL PRACTITIONERS are requested not to apply for any appointment mentioned below without having first communicated with the Honorary Secretary of the Branch concerned, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

New South Wales Branch (Honorary Secretary, 135, Macquarie Street, Sydney): Australian Natives' Association; Ashfield and District United Friendly Societies' Dispensary; Balmain United Friendly Societies' Dispensary; Leichhardt and Petersham United Friendly Societies' Dispensary; Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney; North Sydney Friendly Societies' Dispensary Limited; People's Prudential Assurance Company Limited; Phenix Mutual Provident Society.

Victorian Branch (Honorary Secretary, Medical Society Hall, East Melbourne): Associated Medical Services Limited; all Institutes or Medical Dispensaries; Australian Prudential Association, Proprietary, Limited; Federated Mutual Medical Benefit Society; Mutual National Provident Club; National Provident Association; Hospital or other appointments outside Victoria.

Queensland Branch (Honorary Secretary, B.M.A. House, 225 Wickham Terrace, Brisbane, B.17): Brisbane Associated Friendly Societies' Medical Institute; Bundaberg Medical Institute; Brisbane City Council (Medical Officer of Health). Members accepting LODGE appointments and those desiring to accept appointments to any COUNTRY HOSPITAL or position outside Australia are advised, in their own interests, to submit a copy of their Agreement to the Council before signing.

South Australian Branch (Honorary Secretary, 178, North Terrace, Adelaide): All Lodge appointments in South Australia; all Contract Practice appointments in South Australia.

Western Australian Branch (Honorary Secretary, 205, Saint George's Terrace, Perth): Wiluna Hospital; all Contract Practice appointments in Western Australia. All government appointments with the exception of those of the Department of Public Health.

Editorial Notices.

MANUSCRIPTS forwarded to the office of this journal cannot under any circumstances be returned. Original articles forwarded for publication are understood to be offered to THE MEDICAL JOURNAL OF AUSTRALIA alone, unless the contrary be stated.

All communications should be addressed to the Editor, THE MEDICAL JOURNAL OF AUSTRALIA, The Printing House, Seamer Street, Glebe, New South Wales. (Telephones: MW 2651-2.)

Members and subscribers are requested to notify the Manager, THE MEDICAL JOURNAL OF AUSTRALIA, Seamer Street, Glebe, New South Wales, without delay, of any irregularity in the delivery of this journal. The management cannot accept any responsibility or recognize any claim arising out of non-receipt of journals unless such notification is received within one month.

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